NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

STRATEGIC INFORMATION TECHNOLOGY PLAN

FY 1999 - FY 2004

Information Resources Management Staff

Information Systems Office

Office of Finance and Administration

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This plan was produced in part as input to NOAA's FY 2000 Strategic Planning/Budget Process. As such, information in it may require revisions upon completion of that process. An electronic version is available at "http://www.rdc.noaa.gov/~irm/index.html".

PREFACE

The National Oceanic and Atmospheric Administration (NOAA) Strategic Information Technology (IT) Plan establishes a vision for how information technology contributes to NOAA's ability to accomplish the seven strategic goals identified in the NOAA Strategic Plan. It presents NOAA's requirements for IT systems in terms of these strategic goals, and in so doing it helps to identify the IT actions necessary to reach those objectives. It has a close relationship with NOAA's 5-Year Implementation Plans. This linkage in turn helps to support the NOAA, DOC, and OMB budget-development processes by showing how specific IT initiatives are part of an overall strategy that is essential to attain NOAA's programmatic goals. The plan seeks to integrate information on NOAA's IT programs, requirements, and issues, providing a useful management tool for tracking the general status and direction of IT management within the agency. Finally, the plan responds to concerns in Congress and in the Office of Management and Budget (OMB) that agencies need to improve their strategic IT planning to ensure the sound management of this resource so crucial to Government operations.

The NOAA Strategic IT Plan identifies how NOAA is using IT to achieve its strategic goals. NOAA prepares a more specific annual Operational IT Plan for submission with its budget request, documenting NOAA's accomplishments with its prior use of IT resources and its short-term plans for further actions and accomplishments. Budget Initiatives with substantial IT components also have to be supported with additional documentation detailing specific life-cycle system plans. At the lowest level of planning, an analysis of alternative solutions to a specific IT requirement is required for proposed major acquisitions (requirements for smaller acquisitions have been eliminated or severely reduced).

This Strategic IT Plan has been prepared to support the development of NOAA's 5-Year Implementation Plans. Information on NOAA's strategic systems has been supplied by the individual system managers through their Line Office's Information Technology Coordinator. The strategic issues addressed in this plan were selected for inclusion by NOAA's Information Technology Board, chaired by the Deputy Under Secretary and comprised of Deputy Assistant Administrators and Program Office Directors. The Board is also responsible for reviewing the contents of this plan and recommending endorsement to the Deputy Under Secretary.

As NOAA's 5-year Implementation Plans are revised and budget decisions are made, some of the contents of the Strategic IT Plan will need adjustment. Readers should be aware that this document reflects NOAA's plans at this point in the process – the other parts of the NOAA IT planning system will reflect changes that would affect NOAA's specific budget requests.

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NOAA'S MISSION AND THE ROLE OF INFORMATION TECHNOLOGY

Agency Mission

The mission of the National Oceanic and Atmospheric Administration (NOAA) is to describe and predict changes in the Earth's environment, and to conserve and manage wisely the Nation's coastal and marine resources to ensure sustainable economic opportunities. The NOAA Strategic Plan provides a framework for articulating program goals, and it establishes two mission areas: (1) Environmental Assessment and Prediction and (2) Environmental Stewardship. NOAA's mission is also described on NOAA's home page on the World-Wide-Web (http://www.noaa.gov).

The Role of Information Technology

NOAA is a science-based service agency. In support of its missions, it collects, processes, evaluates, disseminates, and archives vast quantities of information and information products. The effective use of information technology (IT) is a critical success factor in NOAA's ability to accomplish its mission, and the use of IT is integrated into almost all aspects of NOAA's work. NOAA's Strategic Plan recognizes the critical role of environmental data and information services.

IT is being used to allow NOAA to vastly increase the amount and improve the quality of environmental data collected. IT is an integral part of environmental data-collection systems, including radar, sonar, and satellite systems. Once collected, the data must be evaluated and processed to create useful products. NOAA uses advanced computing technology, for instance, to make weather and climate forecasts. IT resources are also essential tools that allow NOAA to produce information products ranging from nautical and aeronautical charts to quotas for specific species of fish.

Once produced, these information products must be disseminated to the public. IT allows NOAA to provide its products to the public in a timely manner. In the case of a weather warning, "timely" means immediately through systems such as the NOAA Weather Radio system or through links to emergency management offices. Other products are disseminated in "real- time" to allow the preparation of forecasts. NOAA also serves the research community that needs reliable and responsive access to NOAA data covering extended periods of time.

NOAA uses IT to create and preserve the Nation's long-term environmental record. The Nation's ability to make informed decisions affecting the environment and the economy hinge on the integrity and completeness of environmental datasets. As NOAA collects and processes a larger volume of environmental data, the systems that archive and preserve the data for posterity must keep pace.

NOAA is a large and diverse organization linked together with a common mission. IT provides one of the links that allows the organization to operate effectively. Internal communication and collaboration are done through electronic mail and video conferencing. In addition, numerous day-to-day operations are conducted through the use of common administrative systems.

The management and use of IT are and will always be key components of NOAA's work.

Vision for the Future

NOAA's overall mission, as expressed in the NOAA Strategic Plan, is stable and is not expected to significantly change over time. NOAA's ability to carry out that mission and improve the products and services provided to the public is rapidly changing. This ability is often attributable to NOAA's use of IT resources. Thus, NOAA's IT vision focuses on finding ways to improve our ability to effectively use IT to accomplish NOAA's strategic goals.

In an era of stagnant or falling budgets, this vision requires that financial and staff resources be allocated carefully. Planning and decision-making must be conducted thoroughly and analytically so that resources can be directed so as to maximize the benefits to the country. Identifiable and measurable goals must be established.

Once investment decisions are made, NOAA's program officials must have the ability to quickly and cost-effectively implement these decisions and acquire the needed resources. Given the rate of technological change, time is of the essence when acquiring modern technology. Lengthy delays during the procurement process are burdensome and potentially costly. Where appropriate, NOAA will strive to share or leverage existing resources for the common good. This includes the development of common standards-based architectures.

Managers responsible for developing new systems must have the benefit of lessons learned from past experiences. The use of "best practices" for project management and software engineering techniques for system design and implementation must be emphasized.

Finally, the performance of operational IT systems must be measured and evaluated. The goal must be continuous improvement, not the status quo.

NOAA'S PROCESS FOR INFORMATION TECHNOLOGY CAPITAL PLANNING AND INVESTMENT

Introduction

NOAA annually invests more than $300 million on information technology (IT). The Clinger-Cohen Act of 1996 recognizes that throughout the Government large sums are spent both to develop new IT systems and to operate existing ones. The Act assigns agencies the responsibility for establishing IT capital planning and investment processes. The goal is to improve the way the Government manages its investments in IT. The Government needs to choose new IT investments which generate the biggest return on that investment to the public. Existing investments, either for projects under development or systems that are operational, must be reviewed to determine whether expenditures are justified based on development progress or system performance. Money being invested in existing systems can be redirected towards systems with the potential for a greater return on the investment.

Definition

NOAA's process for IT Capital Planning and Investment will be an implementation of a more formalized Departmental policy. It will be a process for evaluating IT system investments, including investments for systems that are new, operational, or currently under development. The process will involve the selection of systems for which investments are warranted; the control of systems under development to identify and correct problems; and the evaluation of operational systems to ensure that IT investments are generating the expected results. NOAA's Capital Planning and Investment process will be implemented as part of the Year 2000 budget cycle starting in early 1998.

Guiding Principles

Incremental Approach - Implementing a Capital Planning and Investment process will be a challenging task. The final NOAA process will be the product of a dynamic iterative process. Over time the process will have to be adjusted based on lessons learned and the application of best practices developed both in NOAA and other parts of the Government.

IT Board - NOAA's IT Board, chaired by the Deputy Under Secretary and comprised of the Deputy Assistant Administrators and select Office Directors, will be responsible for implementing NOAA's Capital Planning and Investment process. The IT Board will serve in an advisory role, making funding recommendations to the Under Secretary.

Adapt Existing Processes - NOAA's process will build on existing NOAA management processes. It supplements budget and review processes that already exist. It will provide a framework that integrates these processes to better focus attention on NOAA's IT systems.

Evaluation Criteria - The criteria established by the Director of the Office of Management and Budget will serve as the evaluation criteria that NOAA will use in selecting IT investments. As experience is gained, NOAA-specific evaluation criteria may be adopted.

Phase I - IT Project Selection for New Initiatives

Within NOAA, IT projects requiring new funding are first identified within the Line Offices. Proposed projects are then analyzed and evaluated within NOAA's seven strategic planning teams. A strategic planning team exists for each of NOAA's seven strategic goals. The strategic planning team recommendations are given to the Under Secretary for a final decision on the inclusion of IT budget initiatives in NOAA's budget request. Under NOAA's Capital Planning and Investment process these elements of the existing decision process will not change.

What will change is that the planning and analysis documentation that has in the past been provided to the Department after NOAA has completed its decision process will be developed and used internally as the basis for NOAA's decisions. NOAA's IT Board will also provide a final NOAA-level review and will provide the Under Secretary with recommendations in priority order.

This planning documentation will include an analysis of the potential return on the proposed investment and an analysis of technical and programmatic risk, will identify performance measures for the system, will describe the system's linkage to NOAA's strategic goals, and will describe how the system fits within an appropriate systems architecture. Staff time will be minimized by requiring supporting documentation to be more fully developed as the initiative passes the different approval levels. Initiatives endorsed by the strategic teams will be forwarded to the IT Board with full supporting documentation. The Board will make recommendations for a final decision by the Under Secretary.

Phase II - IT Project Control for Systems Under Development

NOAA's Line Offices have primary responsibility for managing system development efforts. Certain projects, due to their cost or strategic importance, are monitored by the Deputy Under Secretary. Currently two initiatives, CAMS and AWIPS, fall into this category. Under NOAA's Capital Planning and Investment process the IT Board will be the focus of these reviews. The IT Board, under the chairmanship of the Deputy Under Secretary, will monitor system development progress and, when necessary, make recommendations for change. On an as-needed basis special working groups may be established to deal with specific issues.

Other systems will be brought to the attention of the Board as necessary. The Board may also decide to familiarize itself with other system development efforts to ensure that lessons learned can be leveraged for the general benefit of NOAA.

Phase III - Evaluation of Operational Systems

Throughout its history NOAA has developed IT systems to help produce the products and provide the services expected of NOAA. NOAA's Line Offices are responsible for managing these operational IT systems. Although these systems are often continuously being modified and enhanced, they are considered to be operational in that they are being used to help NOAA accomplish its mission.

NOAA's Operational IT Plan provides an annual report on the status of NOAA's IT systems and includes plans for future milestones. The Operational Plan contains a chapter focused on each of NOAA's Line Offices. For future editions, each Line Office will be expected to use the information assembled for the Operational Plan and include in the Plan a summary report on the status of IT systems within that Line Office. This report will identify problem systems and describe the management initiatives being taken to correct the problems. The status of NOAA's IT systems is also monitored throughout the year as a part of NOAA's regular quarterly review process.

NOAA's Operational IT Plan is reviewed and endorsed by the IT Board. As part of this review process, the Board will assess each Line Office's review of its operational systems and is positioned to make additional recommendations to the Under Secretary and the Assistant Administrators or to take NOAA-wide action. Corrective actions could include reallocation of funds to initiatives with the potential for a higher return on the investment, changes in project management, or adjustments in the project's technical approach.

NOAA-WIDE INFORMATION TECHNOLOGY STRATEGIC ISSUES

NOAA's leadership recognizes the importance of IT as an enabler that allows NOAA to accomplish its mission. IT is critically important to NOAA's ability to accomplish each of its seven strategic goals. The individual systems being planned, deployed, or operated to accomplish these goals are described later in this plan. However, IT also needs to be managed at the enterprise level. Over-arching issues and management requirements exist and must be addressed for the organization as a whole.

The strategic issues identified in NOAA's 1998 IT Strategic Plan have not changed from the 1997 Plan. The seven issues that were identified in last year's Plan remain strategically important to NOAA and need to be addressed in a coordinated way. The issues were chosen for their importance to NOAA, their cost, the opportunities to achieve efficiencies through coordinated action, and to meet regulatory requirements. The list of issues was developed and endorsed by NOAA's IT Board.

This section of NOAA's Strategic IT Plan describes these management issues, provides a status report on NOAA's progress in dealing with them, and outlines in general terms NOAA's future plans for dealing with the issue. NOAA's Operational IT Plan will describe in detail the specific initiatives that are being undertaken to deal with these issues over the next few years and provides milestones for tracking progress on those initiatives.

Information Services Delivery

Description: In last year's plan this issue was called "Connectivity and Networking". The issue has been renamed to focus attention on the fact that NOAA's telecommunications infrastructure is key to NOAA's ability to carry out its mission, the delivery of information products and services both internally and externally.

All aspects of the NOAA enterprise, including research, operations, and administration, rely on network communications to conduct the agency's business. This trend has rapidly accelerated as effective network speeds and bandwidths have increased. The collection and dissemination of data are done across networks using the World-Wide-Web. Electronic mail has become the medium of communications for virtually all types of correspondence and collaboration. NOAA's administrative systems, including efforts to implement electronic commerce, are built on a foundation of reliable open-systems communications. Computing resources are also accessed through high-speed links. The slogan "the Network is the Computer", as enabled primarily by the Internet, has become truly descriptive of NOAA's computing environment. In order to realize the true promise of this technology, increased coordination of network resources and vigilance against security threats are both critically important. NOAA also must keep abreast of emerging technologies. A vision of NOAA's networking future must be developed so that NOAA is positioned to benefit from future technological advances.

Status: For over five years NOAA has had in place a Network Advisory Review Board (NARB), a working group empowered to coordinate the development of NOAA networking policy. The NARB membership has representation from NOAA's Line and Program Offices. NARB accomplishments include: issuing a policy document, the NOAA Interoperability Profile (NIP), to provide a standards-based approach to networking that ensures that systems can interoperate; establishing a Network Information Center (NIC) to provide network services to the NOAA community; establishing Network Operations Centers (NOCs) to manage NOAA networks on a campus-wide basis; and developing a NOAA policy on the use of the Internet.

The Information Systems Office (ISO) of the Office of Finance and Administration (OFA) developed a comprehensive status report and assessment of NOAA's telecommunications requirements. This Telecommunications Assessment was coordinated with the NARB, which endorsed the document in January, 1998. The document lists the telecommunications "challenges" that NOAA needs to face in order to maximize its ability to efficiently deliver information services to the public.

NOAA's Program Synergy Team, a high-level group of managers tasked to look for ways for NOAA's programs to work together more effectively, has recommended that a NOAA Intranet be established. The Under Secretary formally endorsed this recommendation in a decision memorandum. A working group has been established to plan and implement such an Intranet. The initiative will focus on improving data and information access within NOAA.

Future Direction: NOAA has recognized that networking and connectivity issues transcend internal organizational boundaries. The Telecommunications Assessment is being used to prepare a NOAA telecommunications "action plan". This plan will document how NOAA will collectively address NOAA's telecommunications challenges, and it will also serve as supporting documentation for a possible Fiscal Year 2000 budget initiative to supplement existing telecommunications funding. A key challenge in this effort is the development of an overall telecommunications architecture for NOAA. This architecture will provide the framework for NOAA's telecommunications planning. NOAA's planning will also benefit from efforts to update its telecommunications baseline, which are being done in conjunction with the Department's telecommunications survey.

Year 2000 (Y2K)

Description: NOAA and its predecessor organizations were pioneers in the use of computer technology. Over the approximately 40 years that computers have been in use, NOAA has developed customized software to handle both programmatic and administrative requirements. As is now well known, hardware and cost limitations often required the use of short-cut software techniques designed to conserve computing storage space. One such technique was to only use two digits to reflect the year, thereby avoiding the additional two digits to reflect the 20th century. For dates beginning in the year 2000, this space-saving technique will cause major errors and failures as programs will read "00" as 1900 instead of 2000.

Although NOAA's systems are, for the most part, not date centric, NOAA still must ensure that its computer systems, both hardware and software, will continue to function accurately when they are called upon to process dates in 2000 and beyond. NOAA must ensure that legacy software is repaired, replaced, or retired; that commercial off-the-shelf software is compliant and will function properly; and that computer hardware is upgraded to process the correct date fields.

The solution to the problem cannot be postponed. Managing the successful completion of the necessary corrective actions is critical to NOAA operations and, more significantly, to the well-being of the Nation.

In recognition of the importance and the time-critical nature of the problem, in June 1996 NOAA established a Y2K Task Force chaired by the Manager for Systems Engineering of the Systems Acquisition Office with participation by each Line and Staff Office. The Task Force initially focused on promoting awareness of the Y2K problem; developing an inventory that determined problem magnitude; and preparing ROM cost estimates for implementing corrections. Subsequently, each Line and Staff Office developed a corrective action plan and is responsible for implementing its plan. The plans address the awareness, assessment, renovation, validation, and implementation phases as required in OMB directives. The Task Force reports regularly to the NOAA IT Board to ensure that NOAA's plans are on track.

Status: The awareness phase is a continuous process. As noted, the NOAA IT Board regularly reviews Y2K progress and issues and disseminates information updates throughout NOAA. The Y2K inventory was developed in the summer of 1996 and is updated regularly. The NOAA inventory will soon be incorporated into a DOC-wide data base that will enable it to respond to Y2K inquiries more effectively.

The inventory assessment identified 130 mission-critical systems, of which 92 are compliant, 24 are being repaired, and the remaining 14 are being replaced. Thirty-seven systems have been retired. The 24 repair systems are being tracked closely and progress is reported quarterly to DOC and OMB. Quarterly reports for May, August, September(interim), November 1997, and February 1998 have been completed.

The assessment phase for all 28 repair systems was completed in October 1997. Four systems are now compliant and have been implemented. Work on the renovation phase for the remaining 24 systems being repaired has begun.

Future Direction: Senior NOAA management is keenly aware of the urgency of the Y2K problem and is determined that NOAA be prepared to support its mission, customers, and partners in the Year 2000 and beyond. Therefore, the Deputy Under Secretary has instituted quarterly progress meetings to review Line and Staff Office status and issues and to assess the need for remedial action should significant problems be encountered. These reviews are in addition to the NOAA IT Board updates.

The pressure from OMB for full implementation has increased significantly. As such, the renovation-phase completion date has advanced three months to September 30, 1998. The

validation-phase completion date remains January 31, 1999. Most importantly, the full implementation is now scheduled to be completed six months earlier – by March 31, 1999. The tighter deadlines will require a close reassessment of the resource requirements and their allocation. OMB has mandated validation and verification of compliance by independent agents, and this will require NOAA to have solid, audit-sustainable test and validation scenarios in place. Therefore, test scripts and compliancy standards must be accelerated and improved. To the extent that test and validation resources cannot be redirected internally, contract support will be required. The Government-wide CIO Committee is developing a source list of contract vehicles to which other Federal Agencies will have access. NOAA is keeping a watchful eye on these.

The Information Technology Management Reform Act of 1996 (the Clinger-Cohen Act) requires that each Federal Agency develop and document its IT architecture. As part of this effort, the DOC's Telecommunications Management Division is undertaking a comprehensive Telecommunications Assessment Project that is also to include Y2K issues. Upon completion of the NOAA effort, which is being coordinated by the Information Systems Office, it will be necessary to adjust NOAA's Y2K inventory, supporting data bases, and the quarterly reporting requirements.

Lastly, Federal Agencies are required to have agreements with States in place by March 1, 1998, to ensure data exchanges are in a contiguous four-digit year format. NOAA is participating in a GAO Government-wide survey of its data exchange partners and practices, both Federal and non-Federal, to determine its requirements in this area.

Commerce Administrative Management System (CAMS)

Description: The Department has recognized the need to have a modern financial and administrative management system in place. The CAMS project is a Department-led effort to develop a common system for use by all Commerce Operating Units, including NOAA. CAMS must be compliant with the Joint Financial Management Improvement Program requirements for financial systems used by the Federal Government.

The implementation of CAMS within NOAA is a management challenge. Not only does the system itself have to be developed and tested, but it has to be implemented throughout NOAA as an operational system. CAMS will replace systems that have been in place for 20 or more years. The required hardware and telecommunications infrastructure must be put in place and NOAA management and staff must be trained to use the system.

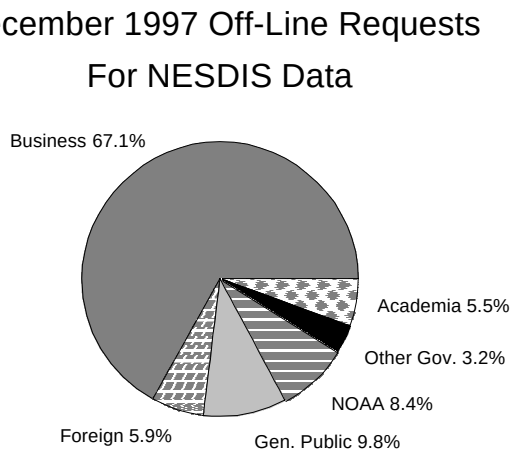
Status: CAMS continues to experience implementation problems and delays. The Department has decided that a "proof-of-concept" is needed before substantive management decisions can be made. Proof-of-concept testing is underway at the Census Bureau with results expected in the summer of 1998. NOAA staff have been assigned to support this effort. NOAA has been directed to scale back its development efforts for now (see "CAMS System Status" on page 78).

Future Direction: NOAA is awaiting the results of the Census Bureau testing. NOAA's long-term plans will be developed based on those results. Development will continue on CAMS-

related subsystems such as the Travel System. As a strategic IT issue for NOAA, future plans for CAMS and implementation efforts will be monitored by NOAA's IT Board.

Data and Information Management

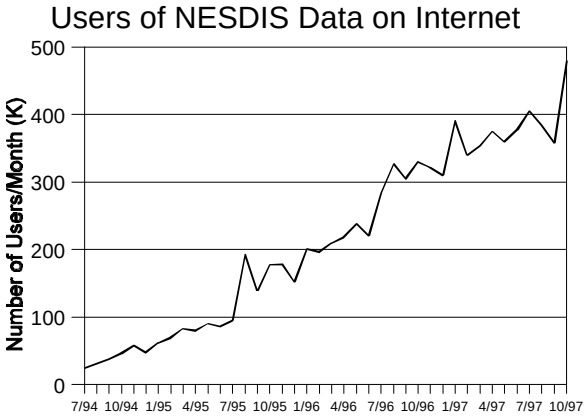
Description: NOAA collects, processes, stores, and disseminates environmental observations and information products derived from these observations. The wide range of customers served by NOAA is illustrated by the accompanying chart showing the distribution of customers who requested off-line data from NOAA's Data Centers during a recent month. NOAA's data are used by many different sectors of society.



For NOAA's information to have value, the public must know what is available and how to readily access it. The OMB has issued Circular A-130, "Management of Federal Information Resources", which establishes the Government's policy on information dissemination. This policy must continue to be implemented within NOAA, and both policy and operational issues must be addressed.

All Federal Government organizations, including NOAA, are faced with the unexpected challenge of managing the retention of electronic mail messages. A recent court ruling invalidated previous policies and requires that historically valuable E-mail messages be retained as official Government records. Like most other Federal agencies, NOAA does not currently have a coordinated system for doing this.

Status: In recognition of the importance of data and information management to NOAA, a special program, the Environmental Services Data and Information Management (ESDIM) program, has been established within the Office of Environmental Information Services. This program provides a central focus for the improvement of NOAA-wide data and information management. ESDIM promotes the preservation, accessibility, and completeness of NOAA's vast environmental data holdings both through the development of NOAA policies and through support for specific data rescue, access, continuity, and data quality projects. Each NOAA Line and Program Office has



representation on the ESDIM team, a working group that reviews ESDIM projects and makes recommendations that guide the direction of the program. This program also leverages efforts within other NOAA programs, such as the Climate and Global Change Program, to ensure that NOAA's data meet exacting scientific standards and are available to the scientific community.

Additional information on the ESDIM program is available on-line at its Home Page at http://www.esdim.noaa.gov/esdim/. This Web site describes the mission of ESDIM and provides information on the individual projects supported by ESDIM. The focus of recent investments has been on improving access to NOAA's data. Increased emphasis on data quality and data continuity issues is expected in the future. The graph illustrates the explosive growth in the number of NOAA clients processing data electronically. In anticipation and recognition of this demand, ESDIM has sponsored the NOAAServer Project to provide integrated one-stop access to many of NOAA's Web servers. The NOAAServer allows users to identify data holdings, generate graphical browse products, download data over the Internet, and order data products off-line. Accessible information includes satellite imagery, weather observations, technical documents, observations of global winds, climate analyses, ocean bathymetry, and ocean temperature and salinity data. The NOAAServer can be accessed from the NOAA Home Page at http://www.noaa.gov by simply clicking on the box labeled "Environmental Data".

NOAA is just beginning to face the issue of managing electronic mail messages as official Government records. We have heard that the National Archives and Records Administration (NARA) will issue guidance on this matter late in 1998. NOAA has begun to look at document management software as a potential solution to this requirement.

Future Direction: Data rescue efforts will proceed with a contract in place for media conversion and digitization to expand public access to NOAA's environmental databases. The ESDIM program will continue to focus on improving access to NOAA data and information resources, with particular emphasis on the completeness of the data. Additional nodes will be added to the NOAAServer system, with enhanced capabilities to subset, browse, and co-plot data. Integrated access to the NOAA Data Centers will be provided through the NOAA Virtual Data System (NVDS). The NVDS, of which the NOAAServer will be a major component, will provide a uniform interface to NOAA's data through a logically-integrated but geographically-distributed system (see page 51 for details on the NVDS design).

Firm plans have not been developed for dealing with electronic mail records. This is an issue where guidance is needed from NARA. The Department should take the lead in developing a coordinated Department-wide approach to deal with this issue. NOAA will continue to investigate alternatives for managing electronic records.

Information Technology Architectures

Description: There is increasing awareness that IT systems need to operate within an integrated environment. Systems often need to interact as they are used to accomplish different but related parts of the NOAA mission. Decisions about hardware and software are best made with a common understanding about the computing environment in which they will be used. The

General Accounting Office (GAO) and OMB have emphasized that an underlying system architecture is required as part of the planning necessary for all IT budget initiatives.

Status: NOAA has taken an incremental approach to the development of system architectures. Rather than attempting to develop a single system architecture for all of NOAA and doing a "force-fit" of NOAA programs into it, architectural plans are being developed at levels that make sense for NOAA's programs. NESDIS has developed an architecture for its NOAA Virtual Data System (NVDS), a system for disseminating NOAA data and information to the public. Within the National Marine Fisheries Service (NMFS) a common system architecture is being developed to guide NMFS' future IT plans. The plan for a NMFS target architecture will be completed in 1998. These efforts have been supported within NOAA by staff from the Systems Acquisition Office who found and have adapted an approach developed within the Department of Defense for systems architecture planning.

Future Direction: NOAA's IT Board has established a working group to develop a standard approach for IT systems architecture plans. This approach will be based on the extensive work done at the Department of Defense (DOD) on Standards-Based Architectures (SBA) for IT systems. More information on the DOD approach can be obtained through the Internet at "http://www-library.itsi.disa.mil/tafim/tafim.html". NOAA will also develop a comprehensive set of architectural plans covering the broad range of NOAA's IT activities. Where possible, these plans will apply across NOAA's organizational boundaries. In other cases, such as for the NWS modernization systems, the architecture will be mission or strategic goal oriented.

Information Technology Security

Description: IT security in NOAA is a broadly-based, decentralized program that relies on Line and Staff Office participation, partnership, and enforcement. The objective is to protect the integrity, availability, and confidentiality of NOAA's sensitive systems and data, including approximately 350 sensitive systems for which security plans have been developed. Dedicated staff resources include one full-time NOAA IT Security Officer (ITSO) within OFA, supported by other OFA staff and part-time Line Office ITSOs. System administrators and managers also have defined roles and responsibilities along with their other duties.

The nature and complexity of security threats is increasing due to dynamically expanding use of networks to accomplish program objectives, and there are insufficient technical staff and resources to maintain continuity of important initiatives. NOAA's ability to perform its mission as a scientific information agency has grown as a direct result of these technological changes, but at the same time, as the business model shifts to one built on remote automated information dissemination, the criticality and complexity of protecting online resources has also increased. The sort of corollary security responsibility that has been NOAA's model of operation in the past is no longer viable in many circumstances. Improperly configured and maintained host systems can be compromised and provide hackers with internal network configuration information and specifics concerning users. The introduction of firewall technology reduces the risks associated with mis-configuration.

Statutory requirements for this program are derived from the Computer Security Act of 1987, (Public Law 100-235); the Office of Management and Budget Circular A-130, "Management of Federal Information Resources"; and the A-130 Appendix III, "Security of Federal Automated Information Resources". NOAA Administrative Order 212-13, "Information Technology Security Management", explains the roles and responsibilities of individuals and organizations involved in computer security within NOAA.

In addition to the formal requirements dictated by OMB, the program is based on security-awareness training and information dissemination, risk assessments, formal security site reviews, corrective actions, and technical support. The core of OMB requirements apply to each system and include a formal security plan, risk analysis, disaster recovery planning, system accreditation, and verification reviews. Security awareness training is provided through new employee and manager training, seminars, publications including an annual bulletin, and conferences. Information dissemination includes: topical workshops, a NOAA Security Web page, security alerts, quarterly meetings among security officers, coordination with other Federal agency security officers, and publications such as the IT Security Planning Guide. Risk assessment and corrective actions occur through formal site reviews and independent technical evaluations (e.g. the Lawrence Livermore Laboratory). To further support these activities NOAA has assembled suites of software for protecting systems (commercial anti-virus and risk-analysis software, public domain Internet tools), and performs periodic security assessments of critical systems.

NOAA has taken the initiative to develop two software products that will facilitate creating, maintaining and tracking IT security plans. ISO is promoting the software with the larger DOC security community in an effort to widen the support base and decrease cost to NOAA. This software will be available for general use by July, 1998.

Status: The principal measure of the success of computer security in NOAA is the degree of awareness and commitment exhibited by its system administrators and end users, i.e., detecting and reporting incidents, network monitoring, and corrective actions for technical or operational controls that result from security assessment reviews. Although that commitment is hard to quantify, there have been a number of noteworthy accomplishments.

First was the acquisition and implementation of a NOAA-wide anti-virus software, the McAfee's VirusScan Suite (VSS) including SecureCast. The Enterprise SecureCast downloads updates to the VSS automatically to all NOAA System Administrators and protects NOAA's systems by always having the latest version of anti-virus software. The VSS protects all servers, except Banyan servers. To protect NOAA's Banyan servers from viruses, ISO procured a NOAA site-license for NetPro Server ScanMaster. Each server can be scanned on an administrator-defined time schedule.

ISO recently implemented an automated ADP Security Incident Form for all NOAA employees to report intrusions and viruses instantly to the NOAA IT Security Officer (ITSO) and the appropriate Line Office ITSO. The NOAA Form 47-43 is located on the NOAA IT Security Web Page. The Web page contains information on security alerts, security news updates, laws,

regulations and policies, UNIX host and network security tools, anti-virus software, security planning process, and miscellaneous documents.

Quarterly IT Security publications are now being produced as a security-awareness training tool. An annual IT security conference was conducted. This one-day conference provided speakers discussing security issues and an exhibition with vendors promoting their security hardware and software. NOAA also completed eight security-assessment reviews for the Office of Oceanic and Atmospheric Research and the National Weather Service in Norman, Oklahoma; Newport, Oregon; Seattle, Washington; Princeton, New Jersey; and Camp Springs, Maryland.

Future Direction: In the future, the elements of NOAA's Security Architecture will include a Virtual Private Network; a secure messaging environment; guidelines for system protection, including tools, precautions, and methodologies; implementation and coordination of "firewalls"; and a NOAA Incident Response Team which would, in addition to coordinating incident response, be responsible for acting as a source of expertise and information regarding vulnerabilities and responses as they pertain to the NOAA environment.

The OMB Circular A-130, Appendix III, Security of Federal Automated Information, was revised in February, 1996. The revised policy on computer security and its implications changes and improves the DOC and NOAA IT Security Program. NOAA will work closely with the Department to develop new policies to stay current with technology, and to review and streamline current policies. One policy change made by the Department is that security plans for systems processing sensitive-but-unclassified information will now be approved at the Operating Unit level, as opposed to the DOC level. With this change, the accreditation of systems should be completed at a faster pace.

OMB Circular A-130 prescribes a series of specific planning activities rather than a theoretical framework. The activities include the development of rules, security training, and the implementation of other operational, management, and technical controls. The Circular further requires that the security arrangements for an IT system must be described in an approved IT Security Plan. Because the revised OMB Circular A-130 requires changes to the security plan format, NOAA has taken the lead for developing the following automated software:

- An automated security plan format using the new format and guidelines that include the OMB A-130 revisions. This new automated format will assist in the preparation and maintenance of IT Security plans and will be used Department-wide.

- An automated Disaster Recovery Plan (DRP). Automated security plans and DRPs eliminates the redundancy in the security planning process, since the input data are interchangeable.

- A new tracking system for NOAA's 400+ IT Systems. This tracking system will provide the capability to track the status of IT Security Plans, including associated milestones, completed actions, and approvals. Each Line Office IT Security Officer will maintain a copy of the tracking software for his or her own systems with the capability to aggregate

data into the main NOAA and DOC database, where standardized and *ad hoc* reporting and querying can be completed. This automated program will be used throughout the Department.

- A new automated risk analysis for both LANS and mainframe systems.

NOAA's future plans for other requirements of the revised OMB Circular A-130 are to:

- Establish a NOAA Computer Incident Response Team, develop standards for reporting and enforcement and for secure transaction processing, and establish a permanent facility for performing system network scans.

- Continue to use the National Security Agency (NSA) for conducting security assessments. NSA performs these reviews at no charge and has been conducting reviews for NOAA for the past seven years. These reviews assure that management, operational, and technical controls are appropriate and functioning effectively. NSA's findings and recommendations for each assessment have been very useful and corrective actions were taken to implement the findings.

- Evaluate and develop policy guidance regarding use of "firewall" technologies in the Washington Metro area and throughout NOAA.

- Develop security rules or system-specific policies. The rules will be based on the needs of the various users of the system. The rules will delineate responsibilities and expected behavior of all individuals with access to the system. Rules are required to be in writing and will form the basis for security awareness and training.

- Publish an IT Security Bulletin quarterly, instead of annually, as an awareness training tool.

IT Human Resource Management

Description: NOAA's ability to accomplish its strategic goals is to a large measure dependent on the ability of NOAA's employees to develop and use IT systems. Pressures to downsize, coupled with rapid advances in technology, have made it difficult to maintain a staff with the technical competence to successfully and efficiently implement new technology. Once implemented, IT systems require a staff of trained users with the skills necessary to effectively use those systems. NOAA must increase the effectiveness of both its system developers and system users. Areas of concern include employee training, career development, recruitment, and retention.

Status: Although this issue was identified in NOAA's previous plan, no resources were devoted to it and no new initiatives were undertaken to deal with this issue. NOAA continues to invest in employee development through locally-controlled funds. A focused NOAA-wide program for IT staff and staff IT development has not been implemented.

Future Direction: A working group is being assembled to address this issue. Representatives from the Human Resources Management and Information Systems Offices will lead the group and do the staff work. Each Line Office will be represented by its Information Technology Coordinator, with other staff participating when needed.

Initial efforts will be directed to developing a program plan for how to maximize the return on NOAA's existing employee development investments. Consideration will also be given to submitting a budget request to fund an employee development program that more fully addresses this critical need. NOAA does not believe that this issue is unique to NOAA. Initiatives that cross DOC Operating Unit boundaries should be actively pursued. This is an area in which NOAA's efforts can benefit the Department as a whole, and efforts in other parts of the Department can benefit NOAA.

NOAA must give this issue substantial attention over the next three years. NOAA's IT talent base is aging – replacement is critical. It is estimated that the current market has a vacancy rate approaching 20% for IT jobs. NOAA needs a concerted effort to address this issue.

NOAA INFORMATION TECHNOLOGY PLANS ORGANIZED BY NOAA'S STRATEGIC PLAN GOALS

The following section is arranged by the goals established by NOAA's Strategic Plan. Under each goal individual information technology systems are addressed. These systems were selected for one or more of the following reasons: (1) they are major information technology systems essential for meeting a strategic goal, (2) they are expected to be the focus of a budget initiative, (3) they are major systems or systems development projects at or near a key decision point in their life cycle, and/or (4) they are major systems with outside interest. Some systems support more than one goal. In these cases they will be addressed in the primary goal being supported and cross-referenced under the other goals.

For each system this plan provides a general description of the system, its role in achieving the NOAA strategic goal, and its general plans. Performance measures for the system's support of the program and milestones for key future actions are included. Budget estimates are provided at the end of each goal's section. These estimates are for only the IT portion of the system, and reflect the money necessary for the related hardware, software, maintenance, services, support services, and personnel costs (as defined by OMB Circular A-11). Both base funding and proposed budget initiative funding are included. The figures for FY 1999 are from the President's budget, while the figures for later years are ones to be included in NOAA's FY 2000 budget request to the Department of Commerce.

STRATEGIC GOAL: ADVANCE SHORT-TERM WARNING AND FORECAST SERVICES

The Programmatic Goal and Objectives: NOAA's vision for 2004 is to provide significantly improved short-term warning and forecast products and services that will enhance public safety and the economic productivity of the Nation. NOAA will enhance its ability to observe, understand, and model the environment, and effectively disseminate products and services to users. The four major objectives of this goal are: to maintain National Weather Service (NWS) Modernization Operations, to maintain satellite continuity, to enhance observations and predictions, and to improve service communication and utilization. Forecasts of environmental conditions depend upon the acquisition of massive amounts of data and the ability to quickly run prediction models using these data. Advances in these areas are dependent upon improvements in information technology and its use. The modernization and restructuring of NWS is dependent upon the successful implementation of information technology systems. The primary Line/Program Offices involved in this goal are NWS; the National Environmental Satellite, Data, and Information Service (NESDIS); the Office of Oceanic and Atmospheric Research (OAR); the National Ocean Service (NOS); the Coastal Ocean Program Office; and the Systems Acquisition Office (SAO).

Performance Measures: The IT systems described in this chapter collectively contribute to the accomplishment of the performance measures set for this strategic goal. While additional measures will be shown for specific systems, it is impossible to separate the contributions of individual systems towards achieving the overall goals. The overall measures are provided here to show how modernization investments will benefit the public.

Advance Short-Term Warning and Forecast Services Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
Tornado warning lead time (in minutes)	10/11	10/11	11/12	12	13	13	14
Tornado warning accuracy (%)	59/66	65/68	70	72	74	75	76
Severe thunderstorm warning lead time (in minutes)	18/18	18	19	20	21	22	23
Severe thunderstorm warning accuracy (%)	84/83	84/83	84	85	86	87	88

Advance Short-Term Warning and Forecast Services Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
Flash flood warnings lead time (in minutes)	40/27	40/30	42/32	44/34	45/36	45/38	45/40
Flash flood warning accuracy (%)	83/76	83/78	85/82	86/85	86	87	88
Severe Coastal Event warning accuracy of landfall (km) w.24 hour lead time	125**/ 145	140/ 135	135	130	130	125/ 130	125/ 130
Precipitation forecasts lead time for 1" precipitation (days in advance)	2.3/2.3	2.3	2.3	2.4	2.4	2.5	2.5

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 97 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 97 Strategic Information Technology Plan.
**This is based on a small number of events (1) so this number may not be representative of the accuracy that can be routinely achieved.

Advanced Weather Interactive Processing System (AWIPS/NOAAPORT):

The Advanced Weather Interactive Processing System (AWIPS) is a technologically-advanced information processing, display, and telecommunications system that is the cornerstone of the NWS modernization and restructuring. AWIPS is an interactive computer system that will integrate all meteorological and hydrological data, and all satellite and radar data for the first time, and enable the forecaster to prepare and issue more accurate and timely forecasts and warnings. Through the implementation of AWIPS, the NWS will meet its mission "to provide weather and flood warnings, public forecasts, and advisories for all of the United States, its territories, adjacent water and ocean areas, primarily for the protection of life and property" more efficiently and effectively. It is a key element of the "maintain NWS Modernization Operations" objective under the "Advance Short-Term Warning and Forecast Services" goal of NOAA's Strategic Plan.

AWIPS is a key element of the modernization of the Weather Service. Development is almost complete and limited deployment is taking place. A decision on nationwide deployment is expected in FY 1998.

AWIPS consists of an integrated suite of automated data-processing equipment that will be deployed to field offices and National Centers to support complex analysis, interactive

processing, display of hydro-meteorological data, and the rapid dissemination of warnings and forecasts in a highly reliable manner. A Wide-Area-Network will connect sites for multi-point-to-point and point-to-point communications. NOAAPORT provides the communications capability, via a satellite broadcast network, to afford internal and external users open access to much of NOAA's centrally collected and produced real-time environmental data. Efforts have been undertaken to ensure the AWIPS hardware platforms and supporting communications infrastructure can accommodate planned future development.

The AWIPS program is capitalizing on recent advances made in relevant technologies. The AWIPS development and deployment employ an incremental, evolutionary build approach where functionality is developed and implemented in multiple stages, thus allowing more frequent integration and evaluation of system components and realization of benefits as rapidly as possible. The initial increment is being fielded with the target architecture and will form the basis upon which future increments necessary to replace the aging Automation of Field Operations and Services (AFOS) system and streamline program operations will be integrated.

The AWIPS site architecture is an Open System implementation. The use of open systems has been a key aspect of the AWIPS design and will continue to influence design and implementation decisions. This approach has resulted in a standards-based, client/server system that provides isolation of applications, data, and system-level functions from hardware implementation and software services to eliminate dependency on vendor-unique products. The system architecture emphasizes the use of commercial-off-the-shelf (COTS) hardware and software, and functional independence of components to deliver a system that is flexible, expandable, and portable. This approach maximizes the intended long-term life of the system.

The AWIPS program is deploying systems concurrently with the incremental development in order to minimize schedule risk. Deployment can proceed independent of development. The most recent build will be retrofitted to already deployed sites; new sites will be deployed with the newest build.

Planning is underway for system evolution activities once the acquisition is complete. These activities will ensure (1) that AWIPS will continue to provide improved mission support capabilities which take advantage of advances in hydro-meteorological science and technology, and (2) that AWIPS technology does not become antiquated or non-maintainable and keeps pace with marketplace technologies.

AWIPS will benefit the operations of the NWS by:

- Providing computational and display functions for operational NWS sites,
- Providing open access, via NOAAPORT, to extensive NOAA datasets that are centrally collected and/or produced,
- Acquiring and processing data from an array of sensor systems (e.g., the WSR-88D, ASOS, and GOES) and local sources,

- Providing an interactive communications system to interconnect NWS operational sites and to broadcast data to NWS sites,
- Disseminating warning and forecasts in a rapid, highly reliable manner, and
- Making the transition from the existing AFOS and to restructured operations.

In particular, AWIPS will provide several service-related capabilities and integration of data at a level not now available through current systems. AWIPS will provide:

- Collection, processing, and display of data via one system;
- Integration of all critical data sources, e.g., radar, satellite, observations, and models;
- Single, integrated forecast operations with interactive analysis of data and forecast preparation;
- The ability to "drive" the NOAA Weather Wire Service and local dissemination circuits and automated NOAA Weather Radio;
- The ability for one WFO to back up a second WFO that experiences system failure;
- The capability to acquire directly local data sets;
- Access to WSR-88D data from non-associated radars in order to not miss events; and
- The capability to ensure consistency of warnings and forecasts over multi-WFO areas.

System Status - Significant development progress was made in the AWIPS program during the last year. Build 1 was completed in March 1997, with the implementation of the eighth software upgrade. A major operational test and evaluation was conducted during the fall of 1996, with smaller tests conducted after each release of an upgrade.

Build 2 was completed in May 1997 and delivered to the existing AWIPS sites. The build focused on changes to the system infrastructure that are independent of the integration of Weather Forecast Office-Advanced (WFO-Advanced) capabilities into AWIPS. They include the initial deployment of a COTS Message Handling System (MHS), upgrades to COTS software, including the operating system and database, tape back-up capability, additional hardware, including a color printer, and automated fail-over. It also provided initial interactive forecast preparation capability at three sites as a risk-reduction activity.

Development of Build 3, release 3.0, was completed in September 1997. This build integrated capability of WFO-Advanced with AWIPS. This integration includes acquisition of GOES data, model grids, and text products; acquisition of WSR-88D products via synchronous interface, storage and management of data; processing, display, and animation of data; generation of

warnings; creation of official text products; dissemination of products through AFOS; interface with Network Control Facility remote monitoring and control of AWIPS operations; and the ability to run hydrologic applications. This release was tested at several operational test and evaluation sites in October and November 1997. Development continued on release 3.1, which will integrate the MHS with the site software and, at selected risk-reduction sites, add interactive forecast preparation capability. This release was completed in December 1997.

Development for Build 4 began during FY 1997. An initial version of the Government's Build 4 software has been installed at the Denver Weather Forecast Office for operational testing. The first Build 4 release is expected to be deployed in June 1998. Final requirements are being defined for Build 5 and 6. In addition, a Program Management Plan was prepared that details the work remaining to be done to complete AWIPS and assigns development responsibilities to the various organizations involved.

On February 12, 1997, Secretary of Commerce William Daley authorized a limited deployment of 21 AWIPS. That deployment is scheduled to be completed by March 1998. In December 1997 the Secretary also authorized an option to procure an additional 19 systems. These will begin to be deployed in mid-summer of 1998. Key Decision Point IV, full-scale deployment of AWIPS, is planned for FY 1998.

Performance Measures - AWIPS contributes to the accomplishment of the performance measures set for the strategic goals of the NWS. The overall performance measures shown for the NWS show how the modernization investments will benefit the public. The performance measure shown below is for the deployment of AWIPS. While there is a measure of nine installations for FY 2000, it is anticipated that these will be completed during Calendar Year (CY) 1999.

AWIPS Performance Measure*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
AWIPS installed	0/27	42/55	84/56	9/0				

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 97 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 97 Strategic Information Technology Plan.

AWIPS Milestones*	FY Goal
Complete Build 2 and install at development phase sites	FY 97/FY 97
Integrate WFO-Advanced into AWIPS and test Build 3	FY 97/FY 97
Begin development of Build 4	FY 97/FY 97
Proceed with limited deployment	FY 97/FY 97
Nationwide deployment decision	FY 98

AWIPS Milestones*	FY Goal
Complete Nationwide deployment	FY 00

* When two years are presented and divided by a "/", the first year represents the FY 97 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 97 Strategic Information Technology Plan.

The National Centers for Environmental Prediction: The National Centers for Environmental Prediction (NCEP) serve as America's primary source for information on the future behavior of our physical environment, including changes in the weather, oceanic conditions, climate variations, and fluctuations in the near-space environment. The NCEP uses sound scientific techniques to convert environmental observations into projections of future conditions that affect our society. In doing so, the NCEP leads the Nation in combining scientific and technological advances to provide the best possible forecasts of our physical environment to meet the daily needs of the American people.

NCEP produces environmental forecasts and warnings. Current supercomputers will need to be replaced with faster models.

NCEP comprises nine centers, and while each center has a specific responsibility for a portion of the NCEP products and services suite, they all work together. Seven of the centers provide direct products to users, while two of the centers provide essential support through the development and operational use of complex computer models of the atmosphere. The task of developing and running these models to make timely environmental predictions requires enormous computing power, so the IT resources of NCEP include supercomputers and powerful scientific workstations. NOAA periodically upgrades the NCEP high-end computing capabilities to improve its capacity to assimilate increasingly rich data from satellites, radar, and other sources, and to run more detailed, higher-resolution models. All of this effort is directed toward improving the accuracy of the Nation's environmental predictions.

The activities associated with the use of high-performance computing at NCEP support NOAA's strategic goals to "Advance Short-Term Warning and Forecast Services" and to "Implement Seasonal to Interannual Climate Forecasts". One of the implementation objectives under these goals is to strengthen prediction systems. In order for the public to fully benefit from the other aspects of the modernization of the NWS, NCEP needs IT resources that can handle the increasing quantity of environmental data and integrate the improvements in meteorological research in a way that results in better forecasting. Increased prediction accuracy for hurricanes, severe thunderstorms, floods, winter storms, etc., has a significant economic impact on the Nation.

The IT architecture at NCEP is fully described in the NCEP Information Technology Plan (March, 1995). Essentially, that architecture is open, heterogeneous, and multi-tiered. Within it, systems employ a common UNIX operating system, communicate via TCP/IP Ethernet, and exchange information using standard data formats.

System Status - In the past NCEP has acquired new high-performance systems on a five to seven year replacement cycle. In recent years, that pace of change has become increasingly unsatisfactory. In part because of this long replacement cycle, NCEP and NOAA currently support operational environmental forecasting with systems that offer only a small percentage of the computational resources available to the national weather services of most other developed nations. In response to this unfavorable condition, a decision was made in 1997 to shorten the replacement cycle for NCEP's high-performance computing systems to three years. Current plans call for the acquisition of a Class VIII system in FY 1998 and for the acquisition of the successor Class IX system in FY 2001. It is further anticipated that this shortened acquisition cycle will include mid-life upgrades for each of these systems. It is significant to note that this concept of more frequent upgrades has received support at both the Department of Commerce and the Office of Management and Budget. This represents a recognition of the critical importance of applying the latest technological advances in computing to further the progress and accuracy of environmental forecasting. Environmental forecasting is a Grand Challenge problem that remains constrained by the availability of computational resources and this circumstance is unlikely to change for many years. The 1997 decision to address this deficiency by committing appropriate resources and to seek more frequent upgrades of critical computing systems was made in recognition of this fact.

NCEP, working closely with representatives of the Department of Commerce and using a stream-lined acquisition process, is proceeding with the Class VIII supercomputer acquisition. The solicitation for this procurement was released on December 11, 1997. The acquisition schedule for the Class VIII calls for award in April, 1998. Other milestones relative to the Class VIII are included in the table below. Another important decision relative to this system is that it will be installed and operated at the Goddard Space Flight Center under a joint agreement between NOAA and NASA.

The Class VIII will be fully operational by February, 1999 and the current Cray C90 system will be withdrawn from service at that time. Other Cray systems, specifically two J90s, will continue in use at NCEP for most of 1999. Because of the new 3-year replacement cycle and the complexity of the acquisition process for high-performance operational systems, the follow-on acquisition for a Class IX system will commence shortly after the completion of the Class VIII acquisition process.

NCEP Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Hurricane Prediction System: 24 hour position accuracy (km)	148/ 145	140	135	130	130	125	125	125
Mesoscale Eta Prediction System over N. America: 24 hr 1″ precipitation skill score	.23/ .22	.23/ .24	.24/ .26	.25/ .27	.26/ .28	.27/ .29	.28/ .30	.29/ .31

NCEP Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Short-Range Ensemble Forecasting System: 24 hr 1" precipitation skill score [1]	.30/ .19	.20/ .21	.21/ .23	.22/ .24	.23/ .25	.24/ .26	.25/ .27	.26/ .28
Global Prediction System: 24 hr aviation wind error (m/s)	7.6/ 7.0	7.0/ 6.5	6.9/ 6.0	6.8/ 5.6	6.7/ 5.3	6.6/ 5.0	6.5/ 4.8	6.4/ 4.6
Coupled Ocean-Atmosphere ENSO Forecast Model: 6-month lead NINO3.4 SST AC score (5-year running window)	.81/ .65	.81/ .65	.81/ .70	.81/ .70	.81/ .75	.81/ .75	.81/ .80	.81/ .80

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 97 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 97 Strategic Information Technology Plan.

[1] The short-range ensemble forecasting system is still experimental and was verified for only a limited number of cases in fiscal year 1997.

The numbers above must be considered with some sophistication. In most cases there is a great deal of inter-annual variability (or noise) that interferes with one's ability to note trends or improvements in these statistical performance measures over the short term.

NCEP High-Performance Computing Milestones*	FY Goal
Complete transition to UNIX operating system	FY 97/FY 97
Initiate procurement action for Class VIII supercomputer system	FY 97/FY 97
Implement high-resolution global data assimilation system	FY 97/FY 98
Implement increased resolution of Eta model (from 48 to 32 km) together with 3D variational analysis	FY 98
Implement direct utilization of GOES radiance data in global model	FY 98
Implement direct utilization of GOES radiance data in regional model	FY 98
Procure and install Class VIII supercomputer system	FY 98
Complete test and evaluation of 4D variational analysis	FY 98
Implement 4D variational analysis	FY 99/FY 98

NCEP High-Performance Computing Milestones*	FY Goal
Class VIII supercomputer fully operational	FY 99
Initiate Class IX supercomputer acquisition process	FY 99
Procure and install Class IX supercomputer system	FY 01
Class IX supercomputer fully operational	FY 02

* When two years are presented and divided by a "/", the first year represents the FY 97 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 97 Strategic Information Technology Plan.

With the acquisition and installation of the Class VIII and Class IX supercomputers, NCEP will be able to operationally run numerical weather prediction models more frequently, at a finer grid spacing, at more atmospheric levels, and look further into the future. Here are some milestones relative to those scientific improvements.

Prediction Model Improvement Milestones	FY Goal
Hurricane Prediction System: 2/day, 16km, 18 levels, 72hrs →4/day, 8km, 36 levels, 120hrs	FY 98 - FY 03
Mesoscale Eta Prediction System (North America): 2/day, 48km, 38 levels, 48 hrs→4/day, 6km, 90 levels, 84 hrs	FY 98 - FY 03
Nested Mesoscale Eta Predictions (small domain): 1/day, 10km, 60 level west→4/day, 4km, 90 level, multiple	FY 98 - FY 03
Short Range Ensemble Forecasting System: 1/wk, 15 member @80km→4/day, 60 member, 3 model@16km	FY 98 - FY 03
Global Prediction System: 126 waves at 28 levels→30 km at 90 levels	FY 98 - FY 03
Global Medium-range Ensemble: 2/day, 16 members @T62/28→4/day, 36 members @T300/70	FY 98 - FY 03
Coupled Ocean-Atmosphere ENSO Forecast T40L18 Pacific Basin→T62L18 Global Ocean	FY 98 - FY 01
Seasonal Climate Forecasts: T40L18 (2nd Tier) Unified Global Coupled Forecast Model (1 Tier) Embedded 50 km Regional Model	 FY 98 FY 01 FY 02

NWS Telecommunications Gateway: The timely, reliable, and accurate dissemination of weather observations and guidance products is the critical mission of the NWS Telecommunications Gateway (NWSTG) operations facility. Delayed or garbled messages can result in the loss of life and property. The mission of the NWSTG supports the NOAA strategic goal to "Advance Short-Term Warning and Forecast Services" and that goal's objective "to effectively disseminate products and services to users." Delayed or garbled information also negatively impacts the Department of Commerce mission of "...safeguarding the nation's economic infrastructure."

The NWS Telecommunications Gateway disseminates weather observations and guidance. It is completing a 3-year upgrade project.

The NWS Gateway provides message-switching services to a national and international community of customers. Flood and storm watches and warnings, weather forecasts, observations, and short-range climate forecasts are distributed to NWS field locations, U.S. Government agencies (FAA, DOD, FEMA, DOA), foreign governments, and private commercial users. The Gateway services a national and international customer base in a near-real-time operational environment.

The operational system has recently been updated to a network-centric architecture which also accommodates the legacy channel-connected structure. The higher capacity switch-engine and servers are necessary to permit the Gateway to collect the ever-increasing volume of observations from new observing systems and to disseminate the more frequent, larger-volume, finer-scale centralized forecasts from the National Centers for Environmental Prediction (NCEP) required for achieving the NWS modernization and restructuring and for improved national weather and climate forecasts.

In the past few years, dataset sizes have experienced explosive growth. NOAA's legacy systems were designed to handle datasets in the multi-Kilobyte-size. The Gateway is now required to routinely accommodate multi-Megabyte-size datasets, a thousand-fold increase. File Transport Protocol (FTP) is the method of choice for the efficient transfer of these large datasets but requires the TCP/IP protocol which runs on networks. The Gateway has been required to adopt a network-centric architecture to keep the Gateway evolution in step with the systems of customers who are adopting network communications as the standard medium of data exchange.

An allied trend is the adoption of the Internet as the communication system of choice by a wide variety of Gateway customers to obtain current information. The Gateway first began providing information on the World-Wide-Web nearly 30 months ago. Last month, the data volume had risen to nearly 500,000 HTML pages of information retrieved from Gateway servers each day. Additionally, more than 20 Gigabytes of model output are provided each day to Intranet customers using FTP. The extrapolation of these exponential growth trends is hazardous at best.

System Status - The NWSTG is in the final year of a three-year upgrade project. The old Hitachi mainframes have been replaced with three new switch-engines operating on Enterprise Server platforms using network technology for inter-machine communication, providing primary, back-up, and development and test functions on separate systems. The old Hitachi disk systems have been replaced with RAID technology systems. An ongoing development which is scheduled to be completed in FY 1998 will result in the complete integration of the software suites formerly running on the three Hitachi mainframes into a single Enterprise Server under a current-technology operating system.

Older servers and their peripheral storage systems have been replaced with higher capacity servers to accommodate the ever-increasing Internet and Intranet access of the datastreams. The development project to implement a COTS DBMS with multi-cast functionality on a server platform to supplement and eventually replace the legacy switching system is mid-way in its realization. The DBMS is installed and routinely ingests the real-time datastream. The next step will be to extract customized datastreams for dissemination. The final step will be to migrate all existing datasets to the DBMS.

Legacy application software operating under proprietary operating systems continues to be migrated to C language operating on open UNIX platforms.

Gateway Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Total volume of data handled through the switch per day (MB)	550/ 550	720/ 680	950/ 810	1050/ 950	2000/ 1000	2000/ 1000	2000/ 1000	2000
Total volume of data placed on the servers per day (GB)	4/4	50	100	150	200	250	300	350
Total volume of data retrieved from the servers per day (GB)	20/20	250	600	650	700	750	800	850

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Gateway Milestones*	FY Goal
Installation of operational system	FY 97/FY 97
Upgrade Network Servers	FY 97/FY 97
Installation of back-up system	FY 98/FY 98
Integration of software suites	FY 98

Gateway Milestones*	FY Goal
Implementation of Multi-casting	FY 99
Upgrade Network Servers	FY 98 - FY 99

* When two years are presented and divided by a "/", the first year represents the FY 97 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 97 Strategic Information Technology Plan.

Next Generation Weather Radar (NEXRAD) System: The NEXRAD system is one of NOAA's prime observation systems for acquiring information about meteorological conditions. Based on Doppler radar technology, a typical NEXRAD system comprises three major subsystems: the Radar Data Acquisition (RDA) subsystem, the Radar Product Generation (RPG) subsystem, and the Principle User Processor (PUP) subsystem. The RDA subsystem transmits the radar signals into the atmosphere. The RDA then receives the returned radar signal from precipitation and other targets and processes this "raw" radio frequency data into representative digital information known as "base data". This base data is then transmitted to the RPG subsystem over either hardwire, fiber optics, or microwave, depending on the radar's location. The RPG takes the base data, and using its computational power and resident algorithms, manipulates and processes the data into various weather "products" (wind velocity, precipitation, etc.). The product data is then passed, upon forecaster request, to the PUP, where it is converted into a visual representation of the digital data, and presented to the forecaster.

NEXRAD is NOAA's Doppler weather radar system. Upgrades to processing subsystems are needed to increase the benefits being obtained from the system and to reduce its costs.

NOAA's strategic goal to "Advance Short-Term Warning and Forecast Services" has as one of its objectives the enhancement of the observations needed to make warnings and predictions. NEXRAD is one of the key systems in NOAA's modernization and restructuring. By using Doppler radar technology, forecasters can observe the presence of precursor conditions of severe weather such as tornadoes and violent thunderstorms. NEXRAD allows for the detection of wind circulation patterns (e.g., mesocyclones) as precursors to tornadic activity and provides data on the direction and speed of tornado cells once they form. NEXRAD also provides quantitative estimates of area precipitation, which are important in hydrologic forecasting of floods and in water resource management. The severe weather and storm wind field detection capabilities offered by NEXRAD have contributed to a significant increase in the accuracy and timeliness of NWS warnings. Nationwide implementation has increased tornado warning lead times from the pre-NEXRAD average of single digit minutes (5-6) to 15-20 minutes for strong tornados (strength F3 or higher) while reducing false warnings rates. The advantages of NEXRAD over conventional radars can be broken down into five basic areas: improved sensitivity, improved resolutions, wind velocity estimation, automated volume scanning, and capability for scientific processing of data.

The potential benefits of this system are currently limited by the original proprietary hardware and software and the complicated nature of the software architecture, which make it very costly to maintain and evolve the system. Furthermore, the limited expansion capacity of the system's design prevents optimal use of weather radar data within the modernized Weather Forecast Offices (WFOs) and National Centers. Advances in the analysis of hydrometeorological weather radar data continue to be made, but not all can be implemented with the existing system. A planned product improvement program has been established to address these concerns with the IT systems and the need for increased functionality. The NEXRAD Product Improvement (NPI) Program was established to plan and implement continued improvement of the NEXRAD system to: (1) meet NOAA's strategic goal to "Advance Short-Term Warning and Forecast Services" for the general public, (2) meet FAA requirements for additional and higher quality products, and (3) meet DOD requirements for a radar user interface interoperable between NEXRAD and other deployable Doppler weather radar systems.

The primary goal of the NPI Program is to modify, augment and improve upon the existing capabilities of the NEXRAD system so it can support, in a cost-effective and timely manner, known operational requirements, as well as those requirements that can reasonably be anticipated. The NWS, working in partnership with OAR, is developing two major upgrades to the NEXRAD radar system. Initially major efforts are being expended in the RPG and RDA data and signal processing areas. The National Severe Storms Laboratory (NSSL) is leading an effort called the Open Systems RDA/RPG, which involves moving the proprietary NEXRAD hardware and software functionality to UNIX-based, open systems architecture. The second upgrade is to the Doppler technology itself. NSSL is working to improve the way the Doppler signal is transmitted and processed, resulting in Dual Polarized Doppler radar. Significant improvements should be achieved in estimating the amount of rainfall and identifying precipitation types (frozen vs. liquid).

Note: In order to meet agency-unique requirements, each of the tri-agencies have a separate upgrade to the PUP in development; Weather and Radar Processor (WARP) for the FAA, Advanced Weather Interactive Processing System (AWIPS) for the DOC, and Open PUP for the DOD. Only the DOD Open PUP activity is considered a part of the NPI Program. Since it will be managed by the NWS, it is included in the budget estimates.

System Status - All of the planned 164 NEXRAD systems have been deployed; 123 of these are for the NWS. Minor hardware and software changes are being implemented as a part of normal operations and maintenance to respond to system needs. The current RPG software build is Build 9.1. It was developed to eliminate narrow-band communications problems and others that were discovered during Build 9 testing. The recommendation to make Build 10 the last software build to be hosted on the existing RPG hardware platforms has been approved.

Two key program documents have been developed by the NPI Program; the Tri-agency Requirements for Operational Use of Weather Radar Data (approved August 1997), and the NEXRAD System Specification (Final draft December 1997). On the technical side, the first two (of five) mini-build stages of pre-production Open RPG (ORPG) software have been completed (December 1996 and July 1997), and the design reviews were conducted. Mini-build 3 will be delivered in January 1998. The Preliminary Design Review for the ORPG hardware was completed in December 1997.

The Open RPG Build 1 system, consisting of new 'open' architecture (with associated hardware and software changes), will be deployed following Beta testing in CY 1999. The decision has been made to use the National Reconditioning Center/National Logistics Supply Center for ORPG kitting and the Air Force for ORPG retrofit deployment. Future Open RPG software builds, to add increased functionality/services, are initially planned in12-month intervals, decreasing to 6-month internals as the system and processes mature.

For the Open RDA, the design of the synchronizer is in progress and a prototype has been built and partially tested. The interface board between the receiver and host computer is being designed. The prototype digital hardware and software for the WSR-88D will be completed by CY 2000.

NEXRAD Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Time needed to make algorithm upgrades[1]	18/18 mo.	18 mo.	18/12 mo.	18/12 mo.	12/6 mo.	6 mo.	6 mo.	6 mo.
RPG AWIPS data flow	56/56 Kbps	56 Kbps	56 Kbps	10 Mbps	10 Mbps	10 Mbps	10 Mbps	10 Mbps
RPG processing capacity (SPEC-Marks)[2]	5/5	5	5/60	60	60	60	60	60

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[1] Faster algorithm upgrades speed up the process of transferring scientific advances to operational use.

[2] Increased capacity allows the implementation of a greater number of algorithms and more sophisticated algorithms on the system.

NEXRAD Milestones*	FY Goal
Complete open RPG Build 1 software	FY 99/FY 98
Complete development of open RPG hardware and software	FY 99
Begin limited production phase field deployment of open RPG	FY 99
Complete deployment of open RPG	FY 01
Complete development of open RDA	FY 01
Begin limited production phase field deployment of open RDA	FY 01

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Geostationary Operational Environmental Satellites (GOES) Ground System:

NOAA GOES provide hemispheric and local coverage for measuring meteorological data used in predicting, monitoring, and observing trends of weather. GOES satellites provide real-time weather data used to develop short-term weather forecasts. Data from the GOES satellites, combined with data from Doppler Radars and Automated Surface Observing Systems, greatly aid weather forecasters in providing better warnings of hurricanes, tornadoes, thunderstorms, winter storms, flash floods, and other severe weather. These warnings help to save lives, preserve property, and benefit commercial interests. Launches are scheduled to replace aging satellites in order to maintain two operational GOES satellites in orbit at all times – one each at an eastern and western continental U.S. longitude. Depending on launch facility availability and economic factors, additional satellites may be launched into orbit at certain times and placed in either standby or storage mode, ready to replace an impaired or failed operational satellite. The last of the present GOES I-M series of spacecraft is scheduled for launch in the year 2000, with a new proto-flight instrument, the Solar X-Ray Imager (SXI). In FY 2002 the first of the next GOES series, N-O-P-Q, will be launched.

> The GOES ground system monitors and controls NOAA's geostationary environmental satellites. Upgrades will be needed for future satellites.

NESDIS operates the GOES satellites. All monitoring and control of the spacecraft is performed from the NESDIS Satellite Operations Control Center (SOCC) through 60-foot satellite antennas located at the Wallops Command and Data Acquisition Station (CDAS) in Wallops, Virginia. The CDAS also operates a shadow control system as a ready backup to the SOCC. The ground systems supporting the GOES spacecraft are divided into two parts: the GOES I-M Telemetry And Command System (GIMTACS) handles all health and safety checks and commanding of the spacecraft; and the Operations Ground Equipment (OGE) performs instrument data earth location, normalization, calibration, and quality monitoring, and spacecraft navigation. GIMTACS also interfaces with the OGE systems to create daily operational schedules. The daily schedule for each GOES consists of more than 5,000 commands to operate the spacecraft and its onboard instruments, and is executed from the GIMTACS system. There is a need to upgrade the GOES ground system to better handle storage and standby spacecraft, to accommodate the Solar X-Ray Imager instrument, and to prepare for the GOES-NOPQ series.

This activity supports the NOAA strategic goal to "Advance Short Term Warning and Forecast Services" by maintaining satellite continuity and enhancing the capabilities to meet the objectives of a modernized NWS and to aid forecasters in providing more precise and timely forecasts.

System Status - The GOES ground system supported the launch of the GOES-10 spacecraft. A request for proposals was issued for the replacement of the GOES Product Monitor system. Proposals have been received from industry and are being evaluated by the government. A procurement for the Wallops backup GOES ground system was initiated.

GOES Ground System Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
# of satellites in operation	2/2	2	2	2	2	2	2	2
# of satellite launches	1/1	0	1	0	1	0	1	1
# of satellites being maintained in standby/storage orbit	1/1	1	2	1	2	1	2	1

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GOES Ground System Milestones	FY Goal
Upgrade GIMTACS workstations	FY 98
GOES L launch	FY 99
Replacement OGE product monitor becomes operational	FY 99
GOES-NOPQ ground systems development begins	FY 99
GOES M launch	FY 00
Replacement GIMTACS TACTS becomes operational	FY 01
GOES-NOPQ ground system - installation and test	FY 03
Operate GOES from the NORC at GSFC	FY 03
GOES N - Q launches	FY 02 - FY 10

Forecast Systems Laboratory (FSL) Massively-Parallel Processor: As NOAA moves into the next decade, it will require substantial increases in computing resources in order to address its mission of describing and predicting the physical, chemical, and biological makeup of the earth and its environment. Massively-parallel processor computers promise to provide the most cost-effective computer power available to meet requirements. Although many of NOAA's applications are ideally suited to a massively-

FSL transfers research technology into operations. FSL is planning to acquire a massively-parallel computer with peak speed of approximately 1 teraflop to be used to run finite-difference models of the atmosphere and ocean.

parallel architecture, a substantial effort is still required to develop applications and procedures to make this transition.

The laboratory's Advanced Computing Branch (ACB) guarantees continued progress toward higher-resolution analyses and forecasts by porting FSL and NCEP models to massively-parallel processors (MPPs), the supercomputers of the future. To achieve the ports, the ACB developed the Scalable Modeling System (SMS) which significantly enhances the ability to develop parallel finite-difference weather models and provides source-code portability between a large subset of existing MPPs.

Currently, SMS has three components: the Nearest Neighbor Tool (NNT), the Scalable Runtime System (SRS), and the Parallelizing Preprocessor (PPP). NNT is a high-level library that can be used to parallelize regular grid weather prediction models. The requirements that were followed in the design and implementation of NNT are: portability of source codes and data files from workstations to massively-parallel computers; ease of programming; minimizing development costs; minimum impact to code appearance; fast performance on a wide variety of machines; and fast I/O operations. SRS is a support subsystem that provides scalable I/O and other system services. PPP is a Fortran source-to-Fortran-source translator that brings the features of NNT into directive (Fortran comment) form. To date, SMS has been ported to the Intel Paragon; IBM SP2; Silicon Graphics Challenge, Origin; Sun Multiprocessor; Hewlett-Packard Multiprocessor; Network of Unix workstations; and Cray T3E, YMP, C90, and J90.

FSL is planning to acquire a massively-parallel computer with peak speed of approximately 1 teraflop and a 15 to 30% improved operational efficiency for running finite-difference models of the atmosphere and ocean. Such a system, with significantly improved processing speed, will be made available as a resource to all of NOAA for developing and testing high-resolution models capable of depicting the detailed nature of weather systems, climate change, and ocean circulations. The system would serve as the technology platform for major NOAA developmental activities. Utilizing this new computer resource, FSL will

- support the North American Atmospheric Observing System (NAOS) Program, taking the lead role in the scientific assessment of current and proposed future observing systems to define the most cost-effective mix of observing systems;

- continue the development of the high-level software library, SMS, to ease the conversion process of software routines from the traditional shared-memory machine to massively-parallel scalable architecture;

- continue to collaborate with NCEP and other organizations and university groups on developing the next-generation state-of-the-art mesoscale weather prediction model that will be used in both operations and research.

System Status - Currently, FSL plans to decommission its 208-processor Intel Paragon in FY 1998. In order to maintain the same order of computing power, FSL is leasing a 32-processor Silicon Graphics (SGI) Origin/2000 computer. FSL plans to acquire and install a new massively-

parallel computer system in late Q3 or Q4 of FY 1999, with a Request for Information released in Q3 of FY 1998.

FSL MPP Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
SMS improvements								
Annual # of new features released to the public domain	1/0	1/0	1/2	2	2	2	2	
Annual # of new computer architectures supported	2/0	2/0	1/3	2	1	2	1	
Annual % efficiency improvement	-	-	-	10	10/20	10/20	-	
NAOS Observing System improvements								
Annual # of observing system configurations evaluated	-	-	-	4	6	5	5	
Develop (with others) a high-resolution non-hydrostatic community mesoscale model								
Annual # of additional applications capable of utilizing the new MPP	1/0	1/0	1	1	1	2	2	
Run initial test of the dynamic model			2	3	2			
Run-time community mesoscale model (in percentage of forecasts length) on the new MPP	-	-	-	-	25/20	20/15	15/10	

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FSL MPP Milestones*	FY Goal
FAA/FSL Proof-of-Concept demo running on Paragon	Deferred by FAA/ FY 97
Release RFI and evaluate proposals for MPP acquisition	FY 98

FSL MPP Milestones*	FY Goal
MPP contract award, system tests, deployment	FY 99
Develop hardware and software infrastructure to support SMS development, and NAOS and model testing	FY 99
Install SMS on the new MPP	FY 99
Begin work to run community mesoscale model	FY 99/FY 00
Begin extensive numerical modeling assessment activities for NAOS	FY 00/FY 01
Release RFI for a new computer acquisition	FY 03

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National Space Weather Information System: The Space Environment Center (SEC) conducts research in solar-terrestrial physics; develops techniques for forecasting; provides real-time monitoring, alerting, and prediction of solar and geophysical events; and prepares data to be archived by NOAA's National Geophysical Data Center. SEC's Space Weather Operations (SWO) Division, operated jointly by civilian and U.S. Air Force staff, is the national and world warning center for disturbances in the space environment that can affect people and equipment.

The National Space Weather System supports the monitoring and prediction of solar and geophysical events. It is now being upgraded and enhanced. A Rapid Prototyping Center has been established to examine models and techniques in a quasi-operational environment.

System Status - The redesign and upgrade of the National Space Weather Information System, which began in FY 96, continued in FY 1997 with the establishment of a Rapid Prototyping Center (RPC). The RPC serves as a vehicle for examining competing space weather models or new observation techniques developed in conjunction with the National Space Weather Program (NSWP), and implementing those that are selected for transition into SEC's Space Weather Operations. The RPC allows new data, analysis techniques, and models to be demonstrated in a quasi-operational environment, with immediate feedback to the development teams. The first two models tested through the RPC, the Magnetospheric Specification Model and an improved Proton Prediction Model, are expected to be fully operational by mid-FY 1998. Following this initial validation period, the RPC is projected to have the capacity to evaluate 4-6 new products per year.

With Phase I development of the National Space Weather Information System complete, SEC is currently in the process of implementing Phase II upgrades and enhancements, which includes a new information dissemination system (IDS), data display system (DDS), and data simulation system (DSS). The goals of this integrated effort are reduced maintenance, increased system and network security, expanded operability, better management and control of user access, maximized

fault tolerance, and reduction in the number of unique interfaces required by each application. The IDS is an object-oriented framework-based distribution system based on the open-standard Common Object Request Broker Architecture (CORBA), which provides a common interface to SEC data stores (real-time and historical data, model output, data simulations, etc.) for local and remote systems through LAN, dedicated WAN, and the Internet. The DDS is a JAVA-based system that consolidates and replaces SEC's current SWO real-time space weather display monitors, remote data display system (XSEL), and Outside User System Internet data displays. The DSS functions through the IDS to provide simulated real-time data for training purposes, model development, and system test and evaluation. All three enhancements to the National Space Weather Information System are expected to be on-line for limited operational use by mid-FY 1998, with full implementation scheduled for FY 1999.

Space Weather Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Total # of products distributed annually via NOAA Weather Wire Service (baseline: 10/96)	13/13	14/20	16/22	16/24	17/26	18/28	18/30	18
Total # of annual products issued from RPC		1	4/3	6/5	8/7	10/9	12/11	14
Total # of major new data streams		1	2	3	4	4	4	4

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Space Weather Milestones*	FY Goal
Implement modernized data acquisition, analysis, display and dissemination system	FY 98/FY 97
Implement two new NSWP models and products using Advanced Composition Explorer (ACE) data	FY 98
Upgrade National Space Weather Information System to allow analysis and numerical guidance	FY 99
Begin program to develop sensor to follow NASA's ACE	FY 00/FY 99
Co-operate with USAF to implement ingest and processing of new solar x-ray data from GOES satellite	FY 01/FY 00

* When two years are presented and divided by a "/", the first year represents the FY 97 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 97 Strategic Information Technology Plan.

Central Environmental Satellite Computer System (CEMSCS): CEMSCS, operated by the NESDIS Office of Satellite Data Processing and Distribution, is NOAA's primary data-processing system for the Nation's environmental satellite data. The primary computing platforms are two IBM mainframe computers (3090-17T and 9021-640) using the MVS operating system. CEMSCS ingests environmental data from NOAA's polar and geostationary spacecraft, and produces environmental products and parameters such as vertical atmospheric measurements (soundings), low-level wind vectors, and sea-surface temperatures. These data and products are critical inputs to NWS analyses and forecast models. The system is also used for satellite image production and serves as the host system for the digital satellite data archive (see the chapter on "Implement Seasonal to Interannual Climate Forecasts"). Although the primary uses for NESDIS polar-orbiting satellite products are as inputs to the forecasts and warnings provided by NWS, these satellite data are also used in many other environmental information contexts by numerous Federal agencies, state governments, and the public and private sector. These uses include analyzing climate change; detecting volcanic eruptions and wilderness fires and tracking associated dust clouds; and monitoring the health of vegetation, the growth of deserts, and deforestation. CEMSCS also ingests and processes data from non-NOAA satellites to produce products to support protection, restoration, and sustainable use of coastal and oceanic ecosystems.

CEMSCS is the central processing system for environmental satellite data. Upgrades are needed to support new requirements and to deal with the Year 2000 problem.

CEMSCS has established a modern distributed-processing architecture to support the many different types of products that will be generated from the datasets created by new satellite systems (NOAA K-L-M-N-N', METOP, GOES I-M, ADEOS, Radarsat, and EOS). The general trend of this architecture is to attach powerful alternative processing computer platforms to the mainframe which produces the numerous products. The mainframe in turn performs the data management, distribution, and archiving functions. As an example, a Cray J916 processor was installed in preparation for processing the Advanced TIROS Operational Vertical Soundings (ATOVS) with the launch of NOAA-K with its advanced suite of instruments.

This activity supports the NOAA strategic goal to "Advance Short Term Warning and Forecast Services" by providing products from polar and geostationary satellites, enhancing the capabilities to meet the objectives of a modernized NWS, and to aid forecasters in providing more precise and timely forecasts.

System Status - The CEMSCS remains a viable operational production architecture for the current base-lined requirements from FY 1997 and for those development projects that were planned, budgeted and started in, or prior to, FY 1997. However, the system must be upgraded and modified to support upcoming functions and requirements that include Year-2000 compliance and the expected delivery of data for the European Meteorological Operational (METOP) and NASA Earth Observing System (EOS) satellites. Without such upgrades the CEMSCS will not be capable of meeting many mission requirements.

With major development started in FY 1996, the Advanced TIROS Operational Vertical Soundings (ATOVS) product development for the new instruments to be aboard NOAA-K continues on schedule. All appears ready for the May 1998 launch of the NOAA-K satellite, with operational implementation of ATOVS slated for approximately 18 months later. Development has begun on a system to process and distribute, in near real-time, Moderate Resolution Imaging Spectroradiometer data from NASA's EOS satellite, scheduled for launch in June 1998. This system will also be used for processing data from future launches of this satellite series.

Several key issues need to be resolved this fiscal year. An upgrade to the IBM enterprise server's operating system software must be accomplished to ensure Year 2000 compliance. This situation provides an opportunity to exercise some economies of scale and, additionally, upgrade the hardware, which was initially targeted for replacement in FY1997. Clearer estimates on the launch of the joint EUMETSAT (the European Organisation for the Exploitation of Meteorological Satellites) METOP satellite are required to refine data processing requirements and system development schedules. In addition, more detailed information regarding the Infrared Atmospheric Sounding Interferometer (IASI) instrument, scheduled to fly aboard the METOP series of satellites, is needed to improve resource estimates for data processing.

CEMSCS Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
% successful product delivery	98/90	90	90	90	90	90	90	90
Total annual # of Global Temperature and Water Vapor Profiles collected (M)[1]	43/ 232	230/ 300	1430	3500	3500	3500	4500	4500
Total annual # of Global Ocean Surface Winds products (M)[2]	89/ 112	.05/ 268	268	268	268	268	268	268
Total annual # of Satellite-derived Winds Profiles (M) [3]	1.4/ 12.2	1.3/ 35	1.3/ 35	1.3/ 35	1.3/ 35	1.3/ 35	1.3/ 35	1.3
Total annual # of Satellite-derived Atmospheric Moisture Profiles (M) [4]	102/ 12	100/ 17	500/ 17	500/ 17	500/ 17	500/ 17	500/ 17	500
Total annual # of Global Ozone Measurements collected (M)[4]	1.12/ .485	1/ .485	1/ .485	1/ .485	1/ .485	1/ .485	1/ .485	1

CEMSCS Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Total annual # of Global Cloud Cover Images collected (K)	57/40	40	40	40	40	40	40	40
Total annual # of Satellite-derived Ocean Products (AVHRR Coast Watch) (K)	300/ 178	178	178	178	178	178	178	178

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 97 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 97 Strategic Information Technology Plan.

[1] The shortfall for FY97 was caused by the slip of NOAA-K launch. The increase in future years depend on funding for EOS and METOP satellite programs.

[2] The shortfall for FY97 and the drastic reduction for FY98 are a result of the failure of the ADEOS satellite. NASA's Quick Scat satellite should return to anticipated levels by FY99.

[3] These numbers were over-estimated in calculations for last year's plan.

[4] These numbers were under-estimated in calculations for last year's plan. Refined as development continues.

CEMSCS Milestones*	FY Goal
CEMSCS Central Satellite Data Processing contract award	FY 97/FY 97
SAA new technology tape drives procured (CEMSCS)	FY 97/FY 97
CEMSCS Mainframe Software/Hardware upgrade	FY 98
ATOVS Software Operational for NOAA-K	FY 98 - FY 99
NASA EOS AM-1 products operational	FY 99
Second New Generation Satellite (NOAA-L) Products Operational	FY 00
NASA EOS PM-1 Products Operational	FY 00
CEMSCS upgrades for METOP processing	FY 02
Cooperative European METOP Satellite Products Operational	FY 03
Next Generation NOAA-N' Products Operational	FY 03

* When two years are presented and divided by a "/", the first year represents the FY 97 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 97 Strategic Information Technology Plan.

Polar-orbiting Operational Environmental Satellites (POES) Ground System:

Satellite Programs - NOAA polar-orbiting satellites provide global and local coverage for measuring meteorological data used in predicting, monitoring, and observing trends of weather. Polar satellites provide real-time weather data used to develop short-term weather forecasts and to provide a continuous data archive for long-term climate studies ranging from the vegetation index to monitoring the ozone layer, and also to provide search and rescue services. Launches are scheduled to replace aging satellites in order to maintain two operational polar satellites in orbit at all times - one crossing the equator at a morning local time, the A.M. satellite, and one crossing at an afternoon time, the P.M. satellite. Operational satellites are replaced by newly-launched satellites when their instruments degrade to a substandard state. The degraded satellites are left in orbit to provide SARSAT (Search and Rescue Satellite-Aided Tracking) and transponder services. At present, there are four polar satellites maintained in orbit, two of which are the operational satellites. The next POES launch is planned for May 13, 1998 (NOAA K). Building upon the POES program, an agreement is in place between NOAA and EUMETSAT on the Initial Joint Polar System (IJPS). This program will include two series of independent but fully-coordinated NOAA and EUMETSAT satellites, exchange of instruments and global data, cooperation in algorithm development, and plans for real-time direct broadcasts. Under terms of the IJPS agreement, NOAA will provide two satellites for flight in the P.M. orbit and EUMETSAT will provide two satellites for flight in the A.M. All satellites will have a common core set of meteorological instruments. The first of the IJPS satellites, METOP-1, is scheduled for launch in FY 2003.

The POES ground system monitors and controls NOAA's polar-orbiting environmental satellites. System changes are needed to support convergence with other polar environmental satellite systems.

On May 5, 1994, President Clinton made the decision to merge the Nation's military and civil operational meteorological polar satellite systems into a single, national system; the Defense Meteorological Satellite Program (DMSP) and the NOAA satellite program will be converged into the unified National Polar-orbiting Operational Environmental Satellite System (NPOESS) with a first launch planned for the year 2007.

IT Requirements - NESDIS operates the NOAA POES satellites. This requires a complex ground system comprised of computers, RF receivers, bit and frame synchronizers, etc., at three sites. All monitoring and control of the spacecraft is performed from the NESDIS Satellite Operations Control Center (SOCC) through antennas located at the Fairbanks Command and Data Acquisition Station in Fairbanks, Alaska, and the Wallops Command and Data Acquisition Station in Wallops, Virginia. The CDAS also operates a shadow control system as a ready back-up to the SOCC. POES satellite operations are conducted on a schedule-driven, automated basis, with capability for operator intervention when deemed necessary. The onboard executing schedules are generated daily at the SOCC and are uploaded through the CDAS. In a first step to convergence, special-purpose components of the DMSP telemetry and command ground system have been relocated to the Suitland SOCC and incorporated into the Integrated Polar Acquisition and Command System (IPACS), an architectural expansion of the Polar Acquisition and

Command System used for NOAA satellites. A similar IPACS configuration will be installed at Falcon Air Force Base, CO, to provide a backup to the IPACS at SOCC. A new Mission Planning and Scheduling Subsystem (MPSS) will be developed for the operation of DMSP satellites as an early step toward convergence. To support METOP, Fairbanks and Wallops CDAS will require new communications, archiving, and RF equipment peculiar to the METOP data format and radio frequency band.

A new ground system will be developed for the converged NPOESS satellites.

This activity supports the NOAA strategic goal to "Advance Short-Term Warning and Forecast Services" by maintaining satellite continuity and enhancing the capabilities to meet the objectives of a modernized NWS and aiding forecasters in providing more precise and timely forecasts.

System Status - IPACS has been delivered and installed and has successfully provided control of a DMSP satellite. The Satellite Operations Management System (SOMS), the new scheduling subsystem for NOAA satellites, has been delivered and installed.

Polar Ground System Performance Measures*	**FY 97**	**FY 98**	**FY 99**	**FY 00**	**FY 01**	**FY 02**	**FY 03**	**FY 04**
# of NOAA satellites in operation	2/2	2	2	2	2	2	2	1
# of DMSP satellites in operation	0/0	2	2	2	2	2	2	2
# of non-NOAA satellites in operation	0/0	0	0	0	0	0	0	0
# of METOP satellites in operation	-	-	-	-	-	-	1	1
# of satellite launches	0/0	1	1	0	1	0	1	0
# of satellites being maintained in non-operational orbit	3/0	0	0	0	0	0	0	0

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 97 performance measurement; since this system was not part of the FY 97 Strategic Information Technology Plan, there were no existing performance measures presented in that Plan.

Polar Ground System Milestones	**FY Goal**
NOAA-K launch	FY 98
MPSS operational	FY 99

Polar Ground System Milestones	FY Goal
Fairbanks DMSP-NOAA integrated system Initial Operational Capability	FY 99
Fairbanks DMSP-NOAA integrated system Final Operational Capability	FY 00
NOAA-L launch	FY 00
NOAA-M launch	FY 01
Fairbanks and Wallops METOP Initial Operational Capability	FY 02
METOP-1 launch	FY 03
NOAA-N launch	FY 04
METOP-2 launch	FY 06
NPOESS Ground System development contract award	FY 04
NPOESS launch	FY 07
NOAA-N′ launch	FY 07

Research Systems: Improvements in NOAA's environmental prediction services depend critically on OAR research to improve NOAA observational systems, develop a better understanding of environmental processes, and enhance predictive models and dissemination systems in a comprehensive approach to natural hazard reduction. OAR research efforts support the design of the next-generation national observing system; improvements in hurricane track and intensity forecasts; enhancements to NEXRAD severe weather detection capability; extending forecasts accuracy out to a week or longer; and, development of techniques to assimilate new data streams into forecast models. OAR develops strategies and demonstration systems of advanced workstations to speed critical weather information into the hands of decision-makers, and evaluates the effectiveness of weather and flood warning products and dissemination systems in meeting the needs of users of NOAA services. The Environmental Research Laboratories (ERL) work in close collaboration with the operational components of NWS and NESDIS and in partnership with the NOAA joint institutes and other university scientists in the weather research focused on systems/modernization and forecasting.

To support systems/modernization, improved forecasts and warnings require more frequent and higher-density observations, faster communications, and better local data-handling systems. Primary research activities include operating and assessing the Wind Profiler Demonstration Network in the central U.S. and developing techniques that can integrate the data from ground-based and satellite-borne profiling systems for more effective use in forecasts; development of LIDARs (Light Detection and Ranging equipment - like radar except that light from lasers is used instead of radio waves) and infrared Doppler multi-frequency radars as research tools to improve

our knowledge of atmospheric winds, turbulence, aerosols, and moisture processes; development of dual-polarization Doppler and passive radiometers to study convective storms and their precursors and to improve the ability to measure rainfall and detect severe winds; and improvements in short-range (1-12 hour) forecasting by the development and evaluation of new local data system technologies and techniques, some of which have already been incorporated into the operational weather forecasting environment. To support forecasting research, improvements in forecasts and warnings for operational weather services require that numerical models be based on sound mathematical and physical concepts of the atmosphere and specific forecasting techniques based on research findings (see specific systems for details).

Within NOAA, research is conducted by many separate organizations in many different locations. These research organizations use a common computing architecture consisting of PCs and scientific workstations interconnected with high-speed networks to data and computing servers. The Internet is used to collaborate with colleagues at other research organizations.

Other Systems: The Automated Surface Observing System (ASOS) continues to be operated and maintained at sites across the country, with improvements made to meet changing user needs and decrease maintenance costs. Satellite Operations and Support Systems are required to support this goal, and will need to be upgraded on an incremental basis. The datasets of the Satellite Active Archive System, described in more detail in the "Implement Seasonal to Interannual Climate Forecasts" section, will support research in this area. Models produced by the Geophysical Fluid Dynamics Laboratory High Performance Computing Systems Division will also support this goal (see the "Predict and Assess Decadal to Centennial Change" chapter for details on the system). Those models include hurricane and severe storm prediction systems and, in cooperation with NWS/NCEP and the National Ocean Service (NOS), an operational coastal ocean forecast system.

Budget Estimates ($K): Includes all hardware, software, operational, and support costs associated with the system. Also includes personnel costs for individuals whose primary task is system development, operations, or support.

System	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
AWIPS	116,910	82,029	33,057	20,385	14,373	0	0
NCEP	23,312	27,693	25,903	25,292	26,965	26,671	27,662
NEXRAD	5,580	7,840	6,250	6,140	12,500	11,900	9,280
GOES Ground System	13,724	12,500	12,500	12,500	12,500	12,500	12,500
NWS Gateway	7400	6100	6500	6800	7000	7000	7000
FSL MPP	500	4,000	5,000	5,000	5,000	5,000	5,000

System	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Space Weather*	225	3,220	2,900	3,000	3,100	3,200	3,300
CEMSCS	14,150	11,600	13,000	11,700	13,300	14,700	15,000
POES	60,453	43,880	73,160	108,950	152,980	3,980**	3,980**

* IT cost only - does not include cost of satellite scientific instrumentation packages.
**The budget costs for Satellite Convergence have not yet been determined and are not included.

Future Investments: Over the last decade the primary focus of NWS IT investments has been on a massive modernization of NWS systems. The NEXRAD, ASOS, and AWIPS systems have been developed. These systems either have been or are in the process of becoming operational. Operational systems are not static systems. NOAA researchers are constantly learning how to better use the new observing systems; new algorithms for product generation are being developed; and enhanced methods for interfacing the systems to human forecasters are tried. In order to maximize the return on the enormous investment that NOAA has already made in the modernized weather service systems, NOAA must move system enhancements that have been proven in a research environment into the operational systems. This will require new investments in IT resources.

STRATEGIC GOAL: IMPLEMENT SEASONAL TO INTERANNUAL CLIMATE FORECASTS

The Programmatic Goal and Objectives: NOAA, working with academic and multi-national partners, will provide one-year lead-time forecasts of precipitation and surface temperature distributions. These forecasts will increase society's ability to mitigate economic losses and social disruption. The objectives set to accomplish this goal are to implement prediction systems, maintain and improve observing and data delivery systems, conduct research for improved climate predictions, deliver climate services, and assess socioeconomic impacts. The primary Line/Program Offices involved in this goal are OAR, NWS, NESDIS, and the Office of Global Programs.

Satellite Active Archive (SAA): The NOAA Satellite Active Archive (SAA) is a digital library of near-real-time and historical satellite data from NOAA's Polar-orbiting Operational Environmental Satellites (POES) and other non-NOAA satellites. Data from the SAA support a broad range of environmental monitoring applications including weather analysis and forecasting, climate research and prediction, global sea-surface temperature measurements, atmospheric soundings of temperature and humidity, ocean dynamics research, volcanic eruption monitoring, forest fire detection, and global vegetation analysis. The system allows users to search an inventory database and browse selected datasets, preview sub-sampled Earth images of that data, and order the data for electronic delivery on the Internet or on computer-compatible media for further processing and analysis. The SAA services a wide user-base (other Government agencies, the private sector, academia, the secondary educational community, and the general public), thereby significantly improving NOAA's delivery of products and services to its customers. The SAA provides interoperability with the Internet (worldwide), the prototype NOAAServer, and Level 3 interoperability with the National Aeronautics and Space Agency's Earth Science EOSDIS (Earth Observing System Data and Information System) systems.

> The SAA is a digital library of near-real-time and historical satellite data. The system is operational. The amount of data available will be doubled and software will be upgraded.

The SAA supports NOAA's strategic goal to "Implement Seasonal to Interannual Climate Forecasts" by providing data to be used in research into this area. Given the planned additional datasets, the SAA will also support most of the other six goals, especially to "Predict and Assess Decadal-to-Centennial Change" and to "Sustain Healthy Coasts".

The current SAA IT open systems architecture is based on scientific workstations and near-line robotic storage coupled to a mainframe, the latter necessary to manage 6.4 terabytes of satellite imagery on digital tape media with an ongoing expansion to 50 terabytes. NOAA's goal for the next five years is to expand robotic storage to make 400 terabytes of data available electronically

to customers. The workstations operating the system will also have to be upgraded to handle this volume of data. The open systems architecture allows incremental additions to be made and the system to be located on one or several different processors at one or more locations.

System Status - The SAA is currently an operational NESDIS data distribution system. In FY 1997, the SAA development staff planned a complete server system re-design using Object Oriented (OO) technologies. A COTS package, Object Team by Cayenne Software, Inc., was procured as an aid in that re-design. Release 1.5 of the SAA was operational February 11, 1998. Several components of that Release contained OO operational code and scripting. Release 2.0, scheduled to coincide with the operational status of NOAA-K, will incorporate more OO design. Release 2.1, scheduled for the autumn of CY 1998, will fully incorporate OO technologies.

As stated, the SAA will implement Release 2.0 which will provide access to NOAA-K data. In addition, the Historic Information Processing (HIP) implementation will begin to place retrospective TOVS, AVHRR, and DMSP data into the active archive, beginning with 1994 data and working backwards to 1978. The archive will increase from the current 6+ terabytes of data to 12+ terabytes by the end of the fiscal year.

The SAA began a cooperative effort with NOAA's Pacific Marine Environmental Laboratory (PMEL) in FY 1997. Under this program, PMEL's FERRET data analysis and display software was incorporated into the SAA's User Interface Server to provide improved customer services for satellite-derived (product) datasets. In FY 1998, the SAA will continue to work with PMEL to improve FERRET and to provide for an interoperable data exchange system with PMEL and other NOAA sites under the NOAAServer implementation.

SAA Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
% of Satellite Active Archive operational	5/5	25	50	65	85	100	100	100
Annual # of datasets added	4/4	4	4	4	4	4	4	4
Monthly average data granules distributed	2,175/ 1,200	1,800	3,000	5,000	7,000	10,000	14,000	14,000
Total # of NOAA Pathfinder products processed annually	2/2	3	4	5	6	7	8	8

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 97 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 97 Strategic Information Technology Plan.

SAA Milestones*	FY Goal
RADARSAT I & DMSP data on-line	FY 97/FY 97
Robotic archive expansion to 50 terabytes	FY 97/FY 97
NOAA-K, AVHRR (1982-94), & TOVS (1978-95) data on-line	FY 98
Robotic archive expansion to 200 terabytes	FY 98 - FY 99
Robotic archive expansion to 400 terabytes	FY 99 - FY 2000
Workstation upgrades	FY 97 - 03
NOAA-L data on-line	FY 99
EOS AM-1 data on-line	FY 00
RADARSAT follow-on data on-line	FY 01
EOS PM-1 data on-line	FY 02
NOAA-M data on-line	FY 03

* When two dates are presented divided by a "/", the first number represents the actual year the milestone was accomplished; the second number represents the original milestone year in the FY 97 Strategic Information Technology Plan.

NOAA Virtual Data System (NVDS): The goal of the NVDS initiative is to provide straightforward, easy access to NOAA-managed environmental data, information, and products to a widely diverse, worldwide clientele. This multi-year initiative is designed to create a logically-centralized, physically-distributed system that enables customers worldwide to electronically browse, access, request (order), and receive data and information while on-line or off-line for most all of the environmental data and information under the stewardship of NOAA/NESDIS, without realizing which data center is providing the products and services.

NVDS is a logically-centralized, physically-distributed system that enables customers to electronically browse, access, order, and receive data and information either on-line or off-line. It is under development and scheduled for completion in FY 2002.

The NOAA/NESDIS Data Centers are the Nation's stewards of the largest and most comprehensive collection of environmental data and information in the world. The Climatological (National Climatic Data Center- NCDC), Oceanographic (National Oceanographic Data Center - NODC), and Geophysical (National Geophysical Data Center - NGDC) holdings represent the chronology of the Nation's environmental history and also that for much of the world. The NVDS initiative is designed to create an effective and efficient means of access to these data and information.

A large portion (over 400 terabytes) of the Nation's archive of environmental data is stored and maintained by NOAA at three national Data Centers and the Satellite Active Archive, located in different areas of the country. The NVDS project is working to integrate the hardware and software at these sites to create a single, unified, on-line, user-friendly system that will allow customers and data users easy access to all of this data through a single gateway. Access will be available through the Internet or by request. Although the data will continue to be stored at multiple locations, this will not be apparent to the user. There will no longer be a need to separately discover, contact, learn the procedures of, and establish methods of paying for data from separate Data Centers.

The Data Centers are migrating to a client/server architecture, moving away from legacy site-specific IT environments. The open-systems architecture supports extensive use of COTS software, rapid adaption to new technologies and procedures, reduction in staffing, the refocus of staff talents to higher-level activities rather than routine administrative matters that can be performed by hardware and software, and optimal targeting of fiscal resources. Placing data on-line for access through the "web" is the highest priority. Data storage and retrieval systems are currently and will continue to be upgraded to support effective and efficient access in response to a variety of query sources with special focus on Internet (web) interfaces.

NOAA strategic goals directly supported by the NVDS initiative are to"Implement Seasonal to Interannual Climate Forecasts" and to "Predict and Assess Decadal to Centennial Change". The NVDS structure significantly increases information and data contributions critical to projects specifically supporting the development and enhancements to "Advanced Short-Term Warning and Forecast Services". The NVDS architecture also contributes to the NMFS and NOS efforts in support of the NOAA strategic goals to "Build Sustainable Fisheries" and "Recover Protected Species". As researchers in many fields begin using a variety of once-isolated data types to obtain a deeper picture of their respective area of environmental concerns, the NVDS will grow in importance. While these data and information already support a very broad spectrum of economic activities in virtually every economic sector, the architecture provided by the NVDS initiative will ensure significantly greater speed of access to petabytes of data by capitalizing on the capabilities of information technologies available to every user from the scientist to the individual person.

Businesses have a long history of using environmental data and information in support of strategic and operational business decision and plans. Scientific understanding and appreciation of the close interrelations between the various environmental disciplines have grown dramatically over the past decade. Requests for the data and information available from the Nation's principal data centers continue to grow at an exponential rate. The NVDS project is focusing on architectures to exploit modern technologies and structures to provide rapid and expanded access to these unique and critical data and information.

System Status -

NVDS Plans and Documents - In FY 1997, the seven Standards-Based Architecture documents were completed in support of this initiative, representing an 100% on-time completion of this

milestone. These include the Architecture Framework, Baseline Characterization, Concept of Operations (CONOPS), Target Architecture, Opportunities Identification, Migration Options, and Implementation Plans documents. Additionally, the Centers have developed a common NOAA National Data Centers (NNDC) Business Plan and a NESDIS Data Centers Architecture Plan. A Centers of Excellence Plan identifies the optimum approach to consolidating business functions and indicates which Center is best suited to perform these functions for all the Centers. This was incorporated into the NNDC Business Plan.

IT Investments - A SUN 5000 workstation, BM Scalable POWERparallel (SP2) System, replacement file servers, and new web servers are examples of IT upgrades procured and installed as one of the basic IT elements supporting NNDC business functions. Other IT enhancements at the Data Centers are addressed within each of the Data Center's respective IT Part 2 Annual Plans. FY 1997 IT investments represent 25% of the total IT investment programmed for all the Data Centers under the NVDS Initiative through FY 2002. A small project called Target Architecture was initiated to establish a logically-centralized, physically-distributed IT structure to electronically process high-demand surface observation forms. The system is due to become fully operational in early FY 1998.

Customer Order Management Processing System (COMPS) - The client/server-based COMPS will provide a single common system used by all the Data Centers and the Satellite Active Archive (SAA) to accept, process, fill, bill, and track customer orders and payments in an automated manner. Build One has been completed and installed at the NODC, representing a 40% completion goal for this measurable performance factor and a 100% completion of the associated FY 1997 milestone. COMPS capabilities will be installed at the other sites in FY 1998. The installation of the SUN 5000 workstation and associated PCs are integral parts of the IT upgrade to support COMPS.

On-Line Data Sets - In FY 1997, the three Data Centers combined added a total of eleven data sets on-line and accessible through the web. The Data Centers will add another 12 new datasets in FY 1998.

Wide-Area-Network - This item addresses the projected need for telecommunications links between the three Data Centers. In FY 1997 the Data Centers were tasked to evaluate the existing capacities, as well as near and long-term needs. This analysis was completed and is reflected as the 10% performance measure for FY 1997.

A fundamental management decision made in FY 1997 was to divide the NVDS system functions into three principal categories:

- Data Management, which comprises the core Data Center operations.
- Data Access and Retrieval, which provide the facilities to enable users to effectively and efficiently recover data and information.

- Accountability of Services, which is a modernization of the fee-for-services operations conducted by the centers to recover costs.

In support of these three fundamental areas, several significant issues were concluded in FY 1997. All planning documents were completed and a detailed programmatic plan was developed though "consensus negotiation" between the Data Centers. Eleven datasets were placed on-line, accessible via the web, providing browse, access, and download capabilities to the customer. New pricing schemes for data and information were proposed, approved and implemented in FY 1997.

Note: the NVDS Initiative currently is only funded through FY 2002.

NVDS Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
% Complete - Data Centers IT Upgrades	25/25	30	50	70	75	80	NA	NA
% Complete - COMPS Implementation @ all Centers	40/40	75	100	100	-	-	NA	NA
Number of Data Sets** for all Centers placed On-Line (Direct Web Access by customers)	11/11	12	12	10	13	12	NA	NA
NVDS Wide Area Network (% Complete)	10/10	20	40	60	80	150	NA	NA

*These are new measures replacing the ones presented in the FY 97 Strategic Information Technology Plan. When two numbers are presented and divided by a "/", the first number represents the achieved FY 97 performance measurement and the second number was the objective.
** UNISYS mainframe migration and Year 2000 projects may influence actual numbers in FY 99 and 00. Also, the introduction of AWIPS capability at NCDC will affect on-line data set activities.

NVDS Milestones*	FY Goal
Standards-Based Architecture Documents Completed	FY 97/FY 97
Customer Order Management Processing System (COMPS) - Build I	FY 97/FY 97
Customer Order Management Processing System (COMPS) - Build II	FY 98
Data Centers IT Upgrades	FY 97 - FY 02

NVDS Milestones*	FY Goal
UNISYS Software Migration Project (SMP)	FY 98 - FY 99
Target Architecture Opportunities implementation	FY 98 - 02/FY 02
Implement Integrated Management System for NVDS	FY 98 - FY 99
NVDS Data Management Policy	FY 99
Unified archive management	FY 01
Complete software conversion to open systems	FY 02

* When two years are presented and divided by a "/", the first year represents the FY 97 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 97 Strategic Information Technology Plan.

Research Systems: OAR supports observing systems necessary for the development of forecasts products and climate models. The Geophysical Fluid Dynamics Laboratory focuses on improving coupled ocean-atmosphere models and assimilation methods, exploring the levels of predictability of model-based forecasts, and providing these models and results to prediction centers. The Climatic Diagnostics Center analyzes the accuracy and utility of observations, models, and assimilation techniques for prediction systems. The Hayes Center (a joint center of the Pacific Marine Environmental Laboratory (PMEL) and the University of Washington) is developing predictive global coupled models of the El Niño-Southern Oscillation (ENSO) phenomena. PMEL is the major contributor to the ENSO Observing System. PMEL implemented, maintains, and is responsible for all aspects of data delivery from the TAO (Tropical Atmosphere-Ocean) array in the equatorial Pacific, the Pacific profiler and upper-air networks, and the global drifter program.

Within NOAA research is conducted by many separate organizations in many different locations. These research organizations use a common computing architecture consisting of PCs and scientific workstations interconnected with high-speed networks to data and computing servers. The Internet is used to collaborate with colleagues at other research organizations.

Other Systems: The NCEP supercomputer system reported on in the "Advance Short-Term Warning and Forecast Services" section of this plan is also used to accomplish NOAA's "Implement Seasonal to Interannual Climate Forecasts" goal. The Coupled Ocean-Atmosphere ENSO Forecast Model performance measure reported for the NCEP system is a measure of the NCEP system's contribution to meeting climate forecast goals.

Budget Estimates ($K): Includes all hardware, software, operational, and support costs associated with the system. Also includes personnel costs for individuals whose primary task is system development, operations, or support.

System	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
SAA	1,500	1,500	2,000	2,000	2,000	2,000	2,000
NVDS	6,500	6,500	4,500	2,500	2,500	N/A	N/A

STRATEGIC GOAL: PREDICT AND ASSESS DECADAL TO CENTENNIAL CHANGE

The Programmatic Goal and Objectives: NOAA will provide science-based options to support international policy and management decisions affecting the future of our global environment. A long-term climate record and a new generation of climate models are needed to predict and assess the climate impact of greenhouse gases trends and forcing agents, ozone-layer depletion and rehabilitation, and air-quality detection and improvement. Specific objectives will be to: characterize the forcing agents of climate change; understand the role of oceans in global change; guide the rehabilitation of the ozone layer; provide the scientific basis for improved air quality; and furnish prediction, assessment, and human-impact information. The primary Line or Program Offices involved in this goal are OAR, NESDIS, and the Office of Global Programs.

GFDL High-Performance Computing: Geophysical Fluid Dynamics Laboratory (GFDL) weather and climate research scientists continue to develop and refine sophisticated numerical models that are providing improved simulations and predictions of atmospheric and oceanic phenomena (e.g. coupled atmosphere-ocean models to understand climate variability on time scales from seasons to thousands of years; modular versions of the SKYHI general circulation model to study the transport, chemical, and climatic impacts of ozone and its precursor gases; and the Modular Ocean Model for oceanographic and coupled model research). Simulations from these models are studied and compared with observed data and current theory to aid in the understanding of the processes that govern the behavior and predictability of these phenomena.

GFDL is developing portable, scalable versions of scientific models and support applications, allowing for procurement of a scalable high-performance system when the current Cray T90 and T3E are replaced.

GFDL's large-scale computing plans address the laboratory's growing scientific-computing needs through a strategy of continued incremental growth in computational and archival storage capacity. As GFDL's benefit/cost analysis indicated, increased system capacity produces important societal benefits through enhancements of the lab's research efforts resulting from more sophisticated models and model physics, more comprehensive modeling experiments, and higher-resolution simulations. GFDL's computing contract, awarded in August of 1995, provides an incremental growth path.

While mission-critical results from GFDL high-performance computing are realized in the laboratory's research accomplishments, the metrics provided are a mechanism for tracking the lab's computing and model-development activities that are critical to the continued progress of the GFDL's research mission.

System Status - The past year has been an important transition year for the high-performance computer system at GFDL with the upgrade of the T90 production system and the installation of the scalable T3E system.

The February 1997 installation of six additional T90 central-processor units (CPUs) and the replacement of all of the T90 central memory with faster CM03 memory allowed the vendor to achieve the contract-specified benchmark performance. However, the reliability of the system following the upgrade has degraded significantly, with the system only achieving the targeted Mean Uptime (MUT) percentage of 96% in two out of the seven months following the upgrade. Even with this subpar availability and the substantial downtime in February due to the upgrade, GFDL was able to average 15,400 CP hours of user time per month for FY 1997. Unfortunately, the first five months of FY 1998 have shown a further deterioration of the reliability of the T90 system with an average MUT percentage of 88.2% for the period; the system did not achieve 96% for any of the first five months of the new fiscal year.

During the coming year, the government will continue to work with Cray Research to seek ways to improve the reliability and usability of the T90 production system that is so critical to the laboratory's research mission. However, given the alarming trend that GFDL is observing in T90 system reliability, it is clearly prudent for the government to consider moving forward the laboratory's next procurement from the currently planned time of FY 2001 to FY 2000 in order to reduce risk to the GFDL climate and weather research activities that are critical to GFDL's many customers, both inside and outside of NOAA. GFDL is currently in the process of evaluating this option, which will, at the minimum, require additional fund for FY 2000.

The scalable 40-processor T3E system was installed in March 1997 and accepted by the government in April after a seven-month delay in delivery. To help compensate for this delay, Cray delivered the next-generation version of the system with faster processors and also increased the disk storage capacity of the system by over 200%. Although the operating system is not as mature as that on the T90 system, it is improving with each release. The monthly system availability of the T3E was below the specified MUT percentage of 96% during the first two months following installation, but has been well above this level for all subsequent months with a mean up-time percentage of 98.9% for the last nine months. While this reliability is far better than that of the T90, the 40-processor T3E system was acquired as a development rather than a production system; it has relatively small computational capacity for most GFDL fluid dynamics problems when compared with the overall computing capabilities of GFDL's production (T90) system.

GFDL has an ever-growing demand for high-capacity, reliable archival storage that is driven by the increased power of its production system and laboratory scientists' need to store and then analyze their model results with higher spatial and temporal resolution. During FY 1997, the monthly growth rate of the system archive increased from an average of 1.2 terabytes per month before the T90 upgrade to around 1.6 terabytes after it, and this rate of monthly growth is likely to continue to grow in the coming year. These accelerating storage demands are putting greater demands on the Storage Tek Redwood cartridge technology that is the high-capacity storage media used in the GFDL archive. Significant episodes of Redwood data loss have occurred over

the past year. The government continues to work with Storage Tek and Cray Research to improve turnaround for efforts to recover this data and to increase the reliability of the Redwood archive. The total size of user data within the complete archive at the end of FY 1997 was 28.8 terabytes and increased to 37 terabytes by February 1998. The total available capacity of the archive at that time was roughly 40 terabytes due to problems with the Storage Tek Redwood media but since has increased to over 60 terabytes.

The scientific user community, without operational requirements for wall-clock performance, has been slow to develop parallel versions of high-end applications. This is a growing dilemma for research centers such as GFDL in view of the high probability that the supercomputer that replaces the current production system will rely heavily on parallelism to produce performance that is acceptable to the laboratory's user community. In view of this programming challenge, GFDL is encouraging users to develop parallel versions of their models and support applications to run on both the production T90 system and the development T3E system. The objective of this effort is to develop portable, scalable versions of all of the laboratory's major applications over the next several years, so that GFDL will be prepared to procure and use a scalable high-performance system when it comes time to replace the current GFDL supercomputers. In FY 1997, GFDL scientists developed parallel versions of two major applications: (1) the SKYHI atmospheric model and (2) the line-by-line radiation code. Both applications have flexible, scalable versions that can run on GFDL's T3E distributed-memory system. In addition, GFDL scientists worked with UNIDATA to port the important support application, NetCDF, to the T3E for the first time. NetCDF is a platform-independent I/O application for reading and writing self-documenting files that is fast becoming the common data format of choice within the oceanography research community and is now a critical part of most of GFDL's models and analysis programs.

In addition to the redesign of these applications, scientists are also beginning to run actual scientific experiments using these parallel applications. The first example of this was the one-third degree resolution SKYHI experiment that was run using four-way parallelism on the GFDL T90. Results from this experiment were recently displayed on the cover of Science Magazine (May 16 issue).

GFDL Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Total user CP hours per month (in units of 1000 T90-CPU hours) on production system	15.4/ 14	15/16	17/18	18/19	80	120/ 130	140/ 170	160
Total usage of archive storage (in terabytes)	28.8/ 20	45/50	70/80	100/ 110	140/ 180	200/ 330	280/ 500	380
Total available archive storage (in terabytes)	40/30	60	90	120	160	230	320	420

GFDL Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Annual # of additional production-capable parallel applications implemented on the production system (currently T90)	1/1	1	1	2	2	2	2	2
Annual # of additional major or support applications converted to the scalable development (T3E) system	3/3	2	2	2	–	–	–	–

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 97 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 97 Strategic Information Technology Plan.

Note: The target metrics for user CP hours per month and storage availability and usage presume that the production system maintains CP and archive availability within contract specifications; this is an obvious concern because of the potential reliability problems with the production (T90) system. Also, the scheduled performance measures for FY 2001 and beyond presume the successful completion of a procurement in that year with a phasing out of the scalable development (T3E) system in FY 2001 and the replacement of the current production (T90) system at that time with a next-generation system after a suitable overlap period.

Several changes have been made to the performance measure entries. First, the previous archive storage measure was separated into two measures, one for actual usage of storage and another for the total available storage. Also, the item, entitled "Major new features implemented in GFDL modular models", was eliminated from this list, because it was judged to be a research-based rather than an information-technology-based measure. Model features are more appropriately described as part of GFDL's research milestones, which are reported separately within the NOAA Strategic Plan.

Finally, as was indicated above, GFDL is presently considering the possibility of moving forward the FY 2001 procurement milestone indicated below to FY 2000 to reduce risks associated with reliability problems observed with the laboratory's production (T90). This option is currently being evaluated.

GFDL Milestones*	FY Goal
Install a scalable (parallel) computer system	March FY 97/ March FY 97

GFDL Milestones*	FY Goal
Upgrade parallel vector system to 13 times YMP benchmark performance	February FY 97/ March FY 97
Upgrade parallel vector system to 16 times YMP benchmark performance	FY 98
Final lease payments under contract	FY 00
New Contract	FY 01

* When two years are presented and divided by a "/", the first year represents the FY 97 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 97 Strategic Information Technology Plan.

Research Systems: OAR monitors trends in the atmospheric distribution of radiatively important trace species and studies their interactions with each other, land, and oceans. OAR conducts major programs to collect and analyze oceanographic data to evaluate models of ocean circulation and predictive models of climate variability. OAR, in partnership with NESDIS' National Climatic Data Center (NCDC), developed and is responsible for maintaining, upgrading, and updating the most frequently-used quality ocean-atmosphere dataset for climate analysis, the Comprehensive Ocean-Atmosphere Data Set (COADS). OAR is the leading organization in the United States with a comprehensive program to understand the earth's stratospheric ozone layer, developing and deploying new instrumentation essential for enhanced observations, analysis, and understanding of photochemical processes on ozone. OAR supports the observational and research program to study key atmospheric reactions and perturbations that may impact air quality both in the United States and globally. Field programs and lab studies are combined with modeling and prediction studies to assist in the development of emission control strategies.

Within NOAA research is conducted by many separate organizations in many different locations. These research organizations use a common computing architecture consisting of PCs and scientific workstations interconnected with high-speed networks to data and computing servers. The Internet is used to collaborate with colleagues at other research organizations.

Other Systems: Some IT systems that primarily support other NOAA strategic goals will also support the objectives of this goal. The datasets of the SAA System and the NOAA Virtual Data System, both described in more detail in the "Implement Season to Interannual Climate Forecasts" section, will support research in this area.

Budget Estimates ($K): Includes all hardware, software, operational, and support costs associated with the system. Also includes personnel costs for individuals whose primary task is system development, operations, or support. Note that these budget estimates do not address the possibility of an additional budget initiative, beginning in FY 2000, to support an FY 2000 procurement of the next-generation high-performance system to meet the demands of GFDL's customers for the laboratory's modeling research in climate and weather. This budget initiative is currently being evaluated.

System	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
GFDL	9,289	9,281	9,281	9,281	9,281	9,281	9,281

Future Investments: Advancements in climate modeling are dependent upon increases in the computational power available to NOAA researchers. While operating its current high-performance computing systems, the GFDL is always engaged in planning for the future. Investments will be required to facilitate transitions to higher-performing systems and to new high-performance computing architectures. Never before has there been such a high demand from GFDL's customers for results from the laboratory's modeling research, due to events such as the Kyoto Climate Conference. However, in the face of this dramatically increasing demand for GFDL research, the laboratory foresees considerable difficulty in keeping pace with the computing capabilities available at modeling research centers abroad without increased funding for GFDL's next supercomputer procurement. This is because foreign modeling centers have access to lower-cost foreign vector supercomputers that are not easily accessible to U.S. centers.

STRATEGIC GOAL: PROMOTE SAFE NAVIGATION

The Programmatic Goal and Objectives: NOAA's goal is to help merchant ships, naval vessels, fishing vessels, and recreational boats safely ply our coastal waters by being electronically guided by space-based navigation and advanced information technologies. NOAA will revolutionize U.S. marine navigation, mapping, and surveying. NOAA also will provide a precise satellite-derived reference system as the basis of its nautical data and for the Nation's geographic positioning needs. Specific objectives for helping to meet these goals are: to build, maintain, and deliver a nautical charting database; to update nautical surveys; to define the national shoreline; to provide real-time observations and forecasts of water levels, tides and currents; and to develop the National Spatial Reference System. The primary Line Office involved in achieving this goal is NOS.

Nautical Charting and Surveying System: The information technology architecture being used to support NOAA's nautical charting and surveying program is desk-top computer systems and off-the-shelf software, with relatively low-risk internal software development.

To support NOAA's strategic goal to "Promote Safe Navigation" NOAA must (1) update nautical surveys of the coastal areas using full-bottom coverage technologies and (2) maintain and deliver the navigational charts to support commercial and recreational use of the Nation's waterways. The goal is to upgrade acquisition technology; optimize hydrographic data transfer on computer systems; build, maintain and deliver a digital nautical database to underpin new electronic navigational systems; and to improve the productivity of the chart-making process in an era of declining resources.

The Nautical Charting Program now supports the entire suite of 1000 nautical charts in raster format. The goal is to also create vector electronic charts to provide accurate and up-to-date electronic chart data for use in electronic navigation systems.

The entire suite of 1000 nautical charts are now available in raster format. Electronic chart navigation systems must have the capability to receive and use electronic source data to update charts easily. NOAA is creating a Vector Electronic Nautical Chart (ENC) in the internationally-accepted S-57 version and format to produce the vector electronic chart data necessary for the most effective use of electronic navigational systems. The vector chart can be used in conjunction with raster data in electronic navigational systems. Clearly these actions depend upon the use of information technology and the achievement of these goals may be delayed by budget limitations.

System Status - The desk-top computer systems and off-the-shelf software used to support NOAA's nautical charting and surveying program are replaced and upgraded as needed. In FY 1997 these micro-computer systems were used successfully to meet the year's performance measures and milestones.

Nautical Charting Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
% of digital database built, maintained, and available for Electronic Nautical Charts (ENC)	20/20	80	100	100	100	100	100	100
% of digital database built, maintained, and available for raster charts	100/ 100	100	100	100	100	100	100	100
% of chart suite updated weekly	20/20	40	100	100	100	100	100	100
% of backlog of critical area surveys completed (cumulative)	17/12	16/15	19/18	22/21	25/24	28/27	31/30	32

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 97 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 97 Strategic Information Technology Plan.

Nautical Charting and Surveying System Milestones*	FY Goal
100% of raster charts database completed, maintained, and available	FY 97/FY 97
Complete the reconfiguration of NOAA ship RUDE's multi-beam data acquisition processing system	FY 98
Complete the reconfiguration of shipboard hydrographic data acquisition and processing systems	FY 99/FY 98
Complete the development of hydrographic smooth sheet production and SCARS workstation processing	FY 99
100% of nautical chart suite updated weekly	FY 99
100% of ENC S-57 database completed, maintained, and available	FY 00
Update weekly the entire suite of nautical charts	FY 00
Maintain raster chart and ENC S-57 databases	FY 01
Update weekly the entire suite of nautical charts	FY 01
Maintain raster chart and ENC S-57 databases	FY 02

Nautical Charting and Surveying System Milestones*	FY Goal
Update weekly the entire suite of nautical charts	FY 02

* When two years are presented and divided by a "/", the first year represents the FY 97 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 97 Strategic Information Technology Plan.

Real-Time Observations and Forecasts of Water Levels, Tides, and Currents:

One of the objectives of NOAA's strategic goal to "Promote Safe Navigation" is to provide ships and other users with real-time data. PORTS (Physical Oceanographic Real-Time Systems) is the means to accomplish this objective. PORTS is a decision-support tool which improves the safety and efficiency of maritime commerce and coastal resources management through the integration of real-time environmental observations, forecasts, and other geospatial information. PORTS measures and disseminates observations and predictions of water levels, currents, salinity, and many other meteorological parameters (e.g. winds, visibility, etc.) needed by the mariner to navigate safely. PORTS systems come in a variety of sizes and configurations. The largest existing installations comprise over 26 separate instruments. The smallest consist of a single water-level gauge and associated meteorological instruments, and are referred to as "PORTS Lite". All PORTS installations provide information that allows shippers and port operators to maximize port throughput while maintaining an adequate margin of safety for the increasingly large vessels visiting U.S. ports.

PORTS provide real-time oceanographic data for port operators and mariners. The focus now is to ensure that the data is quality-controlled and can be used for decision-support.

The approach envisioned is for NOAA to work in coordination with local interests to develop fully-coordinated systems that meet multiple objectives, and that the systems would then be turned over to local interests for operations and maintenance. The PORTS concept works – the constraining factors now are NOAA's ability to fund the acquisition of the accurate oceanographic data the systems need and whether local interests can effectively take control of installed systems.

The systems use individual PCs for data acquisition, as a voice host, and as an Internet gateway. Where modeling is needed, a scientific workstation may be used for that function. The voice data response component is an "infobot". Another component of the PORTS is the development and implementation of regional, model-based nowcast/forecast systems. These would use real-time data input to produce water level and current forecasts for significant locations in an estuary or bay for port operators and mariners. These forecast systems are run daily and require mini-supercomputer platforms for the computations and a scientific workstation for data display and dissemination, especially on the Internet. Some of the forecast dissemination would be via the PORTS information system.

An effort is currently underway to monitor PORTS sites and the NOS water-level network through the use of a system called CORMS (Continuous Operational Real-time Monitoring System), which is a quality-assurance and decision-support system that will ensure the accuracy of the tide and current real-time observations used for navigation and decisions on the safety of life and property. CORMS combines the use of real-time communications, data analysis, Graphical-User-Interface system monitoring, and system watchdog and notification capability to monitor PORTS sites and the NOS water-level network.

System Status - Full systems are presently installed in Tampa, New York, San Francisco, and Houston-Galveston. PORTS Lite systems are installed at Tacoma, Washington and Hampton Roads, Virginia. CORMS (the Continuous Operational Real-time Monitoring System) has become a reality and will become operational in February of 1998, operated by a staff of five. It will be vital for protecting NOAA's liability for the data made available to the public.

PORTS Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Total PORTS & PORTS Lites implemented	0/1	8/4	10	12	14	16	18	20
% of PORTS data quality controlled	0/50	100/ 75	100/ 75	100	100	100	100	100

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 97 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 97 Strategic Information Technology Plan.

PORTS Milestones*	FY Goal
Implement CORMS prototype	FY 97/FY 97
Implement regional forecast systems	FY 98
Implement CORMS operational final phase	FY 00

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The Data Processing and Analysis Subsystem (DPAS) for NWLON: The National Water Level Observation Network (NWLON) provides the foundation for the tidal and Great Lakes vertical water-datum control for the nation. A key IT support system for NWLON is the Data Processing and Analysis Subsystem (DPAS), which processes the data acquired, performs quality-control functions, and makes the data available to users. The system has become fully

DPAS processes and quality-controls tide and water-level data, and makes it available to users. The system is now operational.

operational. It uses a client-server architecture that relies upon RISC-based workstations as the servers and PCs as the clients. Much of the DPAS software was developed for its specialized functions.

For NOAA to fully attain its strategic goal to "Promote Safe Navigation" a modern NWLON is required to provide the real-time tide and water-level information needed for navigation, determinations of marine boundaries, and coastal flood warning forecasts. The DPAS is needed to make the data acquired by the sensors accurate and available.

System Status - DPAS is now operational. The old Perkin-Elmer platform was surplused. A contract has been let to modernize the client side of the DPAS system and move clients to an all-Windows NT environment. Specifically, the new environment will (1) eliminate the need for the non-supported OS2 2.1 operating system; (2) permit the client to use the latest software required by the client application; and (3) will use TCP/IP to communicate between the client and server, eliminating dependence upon Pathworks as a protocol. The new client is now being tested.

DPAS Performance Measure*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
% increase in processing rate of monthly water level station data through DPAS	5/5	25/10	35/12	25	35	45	45	50

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 97 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 97 Strategic Information Technology Plan.

DPAS Milestones*	FY Goal
DPAS becomes fully operational	FY 97/FY 97
80% of NWLON modernized	FY 98
100% of NWLON modernized	FY 99
100% DPAS Satellite Data Collection Platform modernized	FY 00
80% migration to Windows NT server from VMS completed	FY 01
100% migration to Windows NT server from VMS completed	FY 02
100 replacement of DPAS client with Web interface	FY 03

* When two years are presented and divided by a "/", the first year represents the FY 97 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 97 Strategic Information Technology Plan.

Geodetic Support System: The Geodetic Support System is based on an architecture of scientific workstations used as servers and PCs used for analysis and other functions. The Internet is being used increasingly to obtain and deliver data. The system acquires data from Global Positioning System (GPS) Continuously Operating Reference Stations (CORS) and other sources, runs GPS and geoid-reduction software, and performs other functions that require high computational speeds. The GPS satellite tracking data is processed to determine satellite orbits and to establish, maintain, and monitor a national GPS network. Observational data is made available to the user community within 24 hours.

The Geodetic Support System processes data for the National Spatial Reference System and geoid models. It is moving towards a more standardized architecture and requires additional computing power.

The Geodetic Support System performs functions necessary for NOAA to attain its objective to "Develop the National Spatial Reference System (NSRS)", part of NOAA strategic goal to "Promote Safe Navigation". The NSRS provides a common geographic framework and is the foundation for the Nation's spatial data infrastructure, which is essential for mapping, charting, navigation, boundary determination, property delineation, resource evaluation surveys, and scientific applications. The Federal Base Network (FBN), the foundation of the NSRS, comprises both horizontal and vertical positions of monumented stations. The NSRS is complemented by a geoid model, enabling users to determine elevations accurately and efficiently. All data is managed by the NGS Integrated Data Base (NGSIDB) System, which is the source of all products supplied to the user community.

System Status - The Geodetic Support System continues toward a more standardized architecture. The implementation of a NGS Intranet web site will provide for more efficient communication and interaction with the production processing. The operating system will be Microsoft Windows NT and the network will use TCP/IP.

Older RISC workstations that will not run NT are being replaced to enable them to run the current versions of the off-the-shelf production software being used. Old 386/486 PC terminals are also being replaced with Pentium PC workstations for the same reasons. NGS is establishing a configuration-management environment to have all production on a RISC server that serve the X-terminals, PC workstations, and RISC workstations for the processing of adjustments and production of FBN products.

NGS has added two dual-processor workstations for receiving and processing additional CORS and gravity data. These additions have allowed NGS to address the density of the GPS data used in the CORS processing, and to process the additional gravity data which is necessary for the generation of the next gravimetric geoid model for the U.S. and other areas of the western hemisphere. The new dual-processor for gravity data will be able to do parallel processing in the creation of the new geoid using the new Fortran compiler and operating system. Increased IT resources are necessary to support the larger data sets, finer grids, and refined models which will lead to increased accuracy of the gravimetric geoid.

The acceleration of the FBN vertical program shown below is predicated on funding of the proposed Height Modernization Program.

Geodetic Support Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
% of CORS stations operational (of 200)	53/50	65/55	75/60	83/65	88/70	93/75	97/80	100
Accuracy of gravimetric geoid model (cm)	10.0/ 10.0	9.0	8.0	7.5	7.0	6.5	6.0	5.5
% of FBN completed (horizontal)	95/92	100	100	100	100	100	100	100
% of FBN complete (vertical)	33/30	43/31	62/37	80/47	100/ 58	100/ 70	100/ 83	100

* When two numbers are presented and divided by a "/", the first number represents the achieved FY 97 performance measurement or the revised measure for future years. The second number represents the measure presented in the FY 97 Strategic Information Technology Plan.

Geodetic Support System Milestones	FY Goal
FBN Total Horizontal Stations 1474	FY 98
Expand CORS to 150 stations	FY 99
Complete and publish new geoid model	FY 99
FBN Total Vertical Stations 911	FY 99
Perform network adjustment of entire NSRS and populate NGSIDB	FY 00

Aeronautical Charting System: The Aeronautical Charting Program is being transferred to the Department of Transportation in 1999.

Budget Estimates ($K): Includes all hardware, software, operational, and support costs associated with the system. Also includes personnel costs for individuals whose primary task is system development, operations, or support.

System	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Nautical Charting	2,535	2,626	2,721	2,821	2,926	3,036	3,152
Real-Time Observations and Forecasts	100	500	500	500	500	500	500
DPAS	1,700	1,720	1,730	1,740	1,750	2,000	2,200
Geodetic Support System	1,236	1,236	1,240	1,243	1,243	1,245	1,245

STRATEGIC GOALS: BUILD SUSTAINABLE FISHERIES AND RECOVER PROTECTED SPECIES

The Programmatic Goals and Objectives: Through the "Build Sustainable Fisheries" goal, NOAA will increase the Nation's wealth and quality of life by ensuring sustainable fisheries that can provide safe seafood, a healthy fishing industry, and recreational opportunities. Objectives for helping to meet these goals are: assessing the status of fishery resources, advancing fishery predictions, managing for economic growth, ensuring adequate compliance, and providing research and services for fishery-dependent industries. The primary Line/Program Offices involved in this goal are NMFS, OAR, and the Coastal Ocean Program Office.

Through the "Recover Protected Species" goal, NOAA will conserve marine species and recover those in danger of extinction. By 2004, NOAA will be on the road to recovering marine species at risk and maintaining the healthy coastal ecosystems upon which they depend. To accomplish this goal, NOAA's objectives are to conserve species by implementing recovery and conservation plans and to monitor, assess, and predict the status of protected species and their ecosystems. The budget estimates shown may undergo significant revision as a result of the business process re-engineering taking place in NMFS.

Since the same IT systems support both of these goals, as well as the NMFS portion of the Sustain Healthy Coasts goal, they will be dealt with together.

National Marine Fisheries Service System: NMFS is in the process of planning and implementing a Fisheries Information Technology (FIT) architecture which will provide a framework for new systems to be acquired and existing information systems to be evolved to new technologies, as required. This effort resulted from an NMFS-wide evaluation of business practices during FY 1995 via a series of Charter Teams composed of representatives from the Regions and Headquarters. In Fall 1996, the NMFS adopted the recommendations of the Information Management Charter Team that included developing an optimal information management model, creating the position of Chief Information Officer, and forming a National Information Management Board (NIMB). Subsequently, an Architecture Planning Team (APT) was convened, and in early FY 1997 the NIMB approved the process proposed by the APT and approved an Architecture Working Group (AWG) to implement the process. The evolving FIT architecture is intended to comply with the Clinger-Cohen Act of 1996 and the Government Results and Performance Act of 1993.

> The NMFS System supports the management and protection of living marine resources. NMFS is developing a Fisheries IT architecture which will provide a framework for integrating new acquisitions with exiting capabilities.

The FIT architecture will build upon the capabilities currently provided by nine host machines, distributed nationwide, which are supplemented by scientific workstations and PCs. These are linked through a NMFS Wide-Area-Network (WAN) and Local-Area-Networks (LANs) to promote dissemination of information within and outside the agency. Conversion of older software to this relatively new system is underway. To facilitate the goal of non-duplicative, comprehensive, nationwide systems of Fisheries information, the architecture will integrate client-server databases with distribution over the WAN and LANs.

The ability of NMFS to successfully meet the NOAA's goals to "Build Sustainable Fisheries" and "Recover Protected Species" will be significantly enhanced with the implementation of the FIT architecture. More timely access to the required data and information will improve NMFS's capabilities to make predictions concerning the future of living marine resources and their habitat, as well as to estimate the impact of alternative proposed management and protective measures on U.S. citizens and industries. As an example, providing NMFS staff with integrated information and database management systems through the WAN will improve the scientific basis of fishery stock predictions. Effective conservation and management of fisheries, protected species, and essential fish habitat depend upon the quick acquisition, processing, and analysis of the data used to make these decisions. Using more current or comprehensive data may create fisheries management decisions which result in greater flexibility for the fishery industry and other affected sectors. The analysis and dissemination of data also is necessary for longer-term research and planning. Biologic, economic, and social data need to be better analyzed to guide future actions. For example, in the context of watershed and ecosystems-based planning, NMFS needs to evaluate species interaction and regional environmental processes within whole ecosystems, and not just individual fisheries. An efficient FIT system architecture that can provide accurate and timely information to NMFS employees throughout the nation is vital to meet these objectives.

System Status - The NMFS embarked on a ground-up process for defining the objectives and vision for its FIT systems architecture during FY 1997. Approximately 300 interviews of over 1,000 NMFS staff were conducted throughout the year to gather information about the agency's current organization; technology and database systems; and future needs and visions. Additionally, a baseline configuration is underway to characterize the hardware and software used by NMFS staff. The resulting baseline will initialize a standards profile and facilitate "gap analysis" for migration and implementation in future phases. At its July 1997 meeting, the NIMB approved the vision, objectives, business drivers, and IT principles for the FIT architecture which were presented by the AWG. This information forms the initial basis for considering the following five architecture "views" by Target Architecture Teams: work organization, work locations, information bases, applications, and IT infrastructure.

The Target Architecture Team for work organizations and locations (WOL) met in September 1997 to identify the work that NMFS performs to fulfill its mission and draft business functions/logical operating units, logical locations, user classes, and categories for training and IT support. The WOL also is developing white papers which will identify immediate opportunities for IT support and training. The Logical Information Sets (LIS) Team met in October 1997 to begin defining logical information sets, types of information, and categories of access and security. The LIS Team also is developing white papers on data directory and metadata , and

security of NMFS data sets. The Applications Team met in November 1997 to begin defining generic applications and develop white papers on databases and associated data access tools; electronic workflow; email, and scheduling software; a generic systems-development methodology for NMFS applications; and an applications standard profile. The Technology Infrastructure Team met in February 1998 to begin specifying applications environments (e.g., modeling, geographic information systems) and generic technology platforms (e.g., LANs, servers, desktop computers), and to develop white papers on migration and planning, as well as requirements for additional automation. The structural components of the NMFS IT architecture will be developed from these outputs as well as mapping the appropriate interrelationships, e.g., logical information sets to logical operating units. A draft NMFS IT architecture is expected in the spring of 1998.

NMFS System Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
# of databases shared within NMFS and/or with other Government agencies/Councils	39/39	42	46					
# of interoperable, geographically dispersed NMFS information systems	1/1	2	4					
% implementation of Fisheries Information Technology (FIT) Architecture**			15	25	40	80	85	90

*These are revised performance measures from those in the FY 97 Strategic Information Technology Plan. For FY 97 the first number represents the achieved FY 97 performance measurement, the second number is the original performance measure (established after last year's Plan).

**As adopted in FY 98. Given the dynamic nature of the architecture process, and the availability of funds, the target architecture will evolve over the years shown in response to technological advances.

NMFS System Milestones	FY Goal
Define draft Fisheries IT target architecture	FY 98
Conversion and testing of distributed processing systems	FY 99
Initial migration of databases to target architecture	FY 00
Develop and implement regional information and database management systems	FY 97 - FY 03

NMFS System Milestones	FY Goal
Refreshment of technologies to keep pace with industry advances	ongoing

Budget Estimates ($K): Includes all hardware, software, operational, and support costs associated with the system. Also includes personnel costs for individuals whose primary task is system development, operations, or support.

System	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
NMFS FIT System	4,000	4,000	4,000	4,000	4,000	4,000	4,000

STRATEGIC GOAL: SUSTAIN HEALTHY COASTS

The Programmatic Goal and Objectives: NOAA's vision for the next decade is that the Nation's coasts will have more productive and diverse habitat for fish and wildlife, cleaner coastal waters, and sustainable coastal economies based on well-planned development and healthy coastal ecosystems. NOAA will achieve this vision by protecting, conserving, and restoring coastal habitats and bio-diversity, promoting clean coastal waters, and fostering well-planned and revitalized coastal communities. The primary Line/Program Offices involved in this goal are NOS, OAR, NMFS, NESDIS, and the Coastal Ocean Program Office.

Information Technology Support: Information technology provides essential support for the accomplishment of the objectives of this goal. These objectives include the development of Geographic Information System (GIS) tools, databases, ecosystem models, and information management tools for coastal decision-makers. An initiative being proposed would involve the development of databases needed to support a national GIS system, with a desk-top application developed to demonstrate the capabilities of this tool. The Internet and CD-ROMs will also play important roles in disseminating information to coastal management users. Obviously these objectives cannot be attained without the necessary IT resources.

IT support is based mainly on PC and scientific workstation resources. Software and model development are the key IT-related development efforts

This goal is not, however, supported by any individual major systems. Five of NOAA's Line and Program Offices have activities under this goal, with seventeen individual programs involved. The IT to be used is distributed throughout these organizations. Generally the support architecture to be used will be based on the use of scientific workstations as servers and PCs as clients. Some offices will be almost exclusively PC-based, while others will need more scientific workstations in their mix to handle large datasets. The Internet and telecommunications capabilities will play a vital role in those programs responsible for making data available to state and other coastal managers, such as in the CoastWatch Program and in the Coastal Services Center.

Sustain Healthy Coasts IT Support Milestones	FY Goal
Begin implementation of Chesapeake Information Management System	FY 98
Create databases (NC Soils, SC Geographic)	FY 98
Design and construct database for GIS tool	FY 99
Implement pilot GIS in other regions	FY 99

NOAA-WIDE INFRASTRUCTURE CAPABILITIES

NOAA also has initiatives underway that serve NOAA as a whole. These initiatives are not directed at accomplishing any single strategic goal, but are directed at providing the underlying infrastructure or improving the administrative services that allow NOAA to efficiently operate as a unified organization and to support collaboration and teamwork.

Commerce Administrative Management System (CAMS): CAMS is a Department-wide effort to modernize and integrate its financial and administrative management systems and streamline related business processes. The goal of CAMS is to employ modern technology to provide managers with standardized, accurate, and timely information to manage their resources while at the same time reducing administrative costs. Additionally, CAMS will be compliant with the Joint Financial Management Improvement Program (JFMIP) requirements for financial systems.

CAMS is undergoing proof-of-concept testing at the Bureau of the Census. Future plans will be based on the results of these tests.

The mission of the NOAA Office of Finance and Administration CAMS Program Office is to coordinate the development and implementation of the Core Financial System (CFS) and other CAMS component systems throughout NOAA. NOAA is using a "team approach" in designing, developing, and implementing these component systems and an incremental approach to implementing CAMS NOAA-wide.

The supporting system architecture for CAMS is an increasingly Open Systems Environment that provides for interoperability (i.e., linkage or inter-connectivity) of hardware/software as well as portability of data and applications across diverse computing environments. Inter-connectivity of the systems will evolve to become seamless; financial data will be administered by the program managers; and distributed data processing will support bureau-unique, program-unique "business cultures."

The CAMS concept of operations is to use standard financial management software across hardware platforms, maintain that software centrally, ensure a single-entry source capture of financial data at point-of-origin, and implement paperless processing using electronic forms, routing, and approvals. Furthermore, CAMS will provide for the automatic validation of funds availability and commitment/reservation; "embed" intelligence that improves data integrity and reduces the need for reconciliations/corrections; and make available up-to-date official financial data on-line.

Tangible benefits that will be realized from CAMS are cost and FTE savings, improved productivity, elimination of "cuff" systems, Electronic Commerce/Electronic Data Interchange, and Prompt Payment Act compliance. Other benefits include improved timeliness, accuracy, and reliability of financial data; improved services/products (mission support); state-of-the-art new

systems; increased capability; more efficient database manipulation; productivity increases; better user-interfaces; and improved stewardship.

System Status - The NOAA CAMS initiative has undergone a change in strategy during the previous 12 months, though both DOC and NOAA remain committed to the successful implementation of CAMS. The Department has made the decision to focus most Department resources on a Proof-of-Concept that would confirm the viability and effectiveness of CAMS. The Census office, located in Suitland, has been selected as the pilot site and has remained the focus of attention since September 1997. The Census pilot is projected to be complete in June 1998. An assessment will then be conducted from July 1998 through September 1998. Following the assessment, a determination will be made regarding the continuation of the CAMS project throughout the DOC bureaus, including NOAA.

DOC management officials decided to implement CAMS using a phased approach, using a pilot implementation. DOC felt that a phased deployment approach would:

(1) Allow DOC to channel its limited resources into one implementation effort and have each bureau play an active role in the initial implementation;

(2) Minimize the risks associated with CAMS and provide DOC an effective approach to manage program scope and costs; and

(3) Allow DOC to verify that CAMS works as it was intended before moving on to multiple implementation efforts (Proof-of-Concept).

As part of the change in focus, the NOAA CAMS effort was restructured in September 1997. As a result of this change in strategy, some NOAA Implementation Center (IC) staff have returned to their “home offices,” and some NOAA IC personnel have been reallocated temporarily to the DOC IC and to the Census offices in Suitland. The NOAA CAMS IC staff, although temporarily reduced, continues to pursue implementation of NOAA CAMS. During the Census pilot, NOAA has chosen to focus its resources on the expansion of Accounts Payable documents beyond those implemented in July of 1997. The NOAA IC is also dedicating resources to the implementation of Travel Manager and the CAMS travel interface. Both of these efforts are expected to yield benefits to both the NOAA Finance Office and the NOAA Line Offices.

CAMS Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Accounts Payable								
# of days for transmission of documents from NOAA end-users to Procurement and Finance	-	5	3	1	1	1	1	1
# of days for approval process of documents	-	5	3	1	1	1	1	1
# of days for reimbursement of expenses to employees	-	10	8	6	1	1	1	1
Reduce/Eliminate reliance on current legacy systems	-	10%/ 50%	30%/ 100%	50%/ 100%	100%	100%	100%	100%
Reduce Prompt Payment Act interest payments	-	5%	10%	25%	50%	50%	50%	50%
Eliminate duplicate key entry	-	-	10%	30%	60%	60%	60%	60%
Increase electronic file transfer (EFT) payments	-	10%	50%	100%	100%	100%	100%	100%
Budget Execution								
Eliminate duplicate key entry	-	-	10%	30%	50%/ 60%	50%	60%	70%
Accounts Receivable								
Collection of delinquent billings by administrative offset	0/1	0/1	10%/ 50%	50%/ 100% **	100%	100%	100%	100%
# of days for recording deposits (Lockbox)	-	3	3/2	2/1	1	1	1	1
# of minutes for dunning notices (Delinquent Bills)	-	60	60/15	15/5	5	5	5	5

CAMS Performance Measures*	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
# of minutes to create reimbursable billing	-	35	35/5	5	5	5	5	5
Automated calculation of Debt Collection Act	0%/ 80%	0%/ 80%	80%/ 100%	100%	100%	100%	100%	100%

*When two numbers are presented and divided by a "/", the first number represents the revised measure for future years. The second number represents the measure presented in the FY 97 Strategic Information Technology Plan.
** Assumes all TIN's received

CAMS Milestones*	FY Goal
Acquire, install, and begin operation of test and development platform (Digital Equipment alpha computer) needed for CAMS operation in NOAA.	FY 97/FY 97
CFS: General Ledger (closing); Limited deployment of Accounts Payable. CAMS: Limited deployment of Procurement and Travel.	FY 97/FY 97
CFS: General Ledger (closing); Full deployment of Accounts Payable; Limited deployment of Accounts Receivable; Set up Budget Execution and Cost Accumulation. CAMS: Full deployment of Procurement, Travel, Bankcard, Grants, and T&A/Labor Cost.	FY 99/FY 98 FY 99/FY 98
CFS: Full deployment of General Ledger, Accounts Receivable, Budget Execution, and Cost Accumulation. CAMS: Full deployment of Real Property, Personal Property, and Inventory. Limited deployment of Contracts.	FY 99 FY 99
CFS: Enhance CFS to 100%. CAMS: Full deployment of Contracts. Enhance all modules to 100%.	FY 01 FY 00

* When two years are presented and divided by a "/", the first year represents the FY 97 accomplishment or the revised goal for future years. The second year represents the goal presented in the FY 97 Strategic Information Technology Plan.

Resource Development Center (RDC): The Information Systems Office (ISO) of the Office of Finance and Administration (OFA) operates the Resource Development Center in Landover, MD, as NOAA's primary administrative and management information facility. NOAA's existing financial management system (FIMA) is currently operated at the RDC, as well as NOAA's Grants Management System and Controlled Correspondence Business System. NOAA's implementation of the Commerce Administrative Management System (CAMS) will be

operated at this facility. The financial systems and data bases are operated on a DEC-Alpha multi-processor system.

The RDC also operates NOAA's electronic mail hub. The e-mail hub allows NOAA's various e-mail systems to exchange messages. The hub has proven to be an efficient way to facilitate information interchange within NOAA. On an average day over 30,000 e-mails are processed through the hub. Over the coming years the e-mail hub is expected to process an increasing volume of e-mail traffic. Projections call for as much as a doubling of today's current traffic of over 6.5 million messages per year. The RDC will manage its computing infrastructure to maintain the listed e-mail performance measures.

The RDC is developing a Network Operating Environment for OFA as a strategy and architecture for moving from the current Banyan LAN Operating System to a vendor-independent, standards-based open-network architecture.

The RDC also manages NOAA's administrative Wide-Area-Network (WAN). The WAN is based on frame-relay technology and the TCP/IP communication protocol. It interconnects NOAA headquarters in the Washington D.C.- metropolitan area with the four Administrative Support Centers (ASCs) in Seattle, Boulder, Kansas City, and Norfolk. Facilities in the Washington D.C. area are interconnected with 10mbs Fiber Network Service (FNS). This WAN will be incorporated into any future NOAA Intranet.

The RDC also manages and operates many of NOAA's administrative web pages. These web pages allow information to be disseminated both internally to NOAA staff and externally to NOAA customers, the public. The number of Internet accesses (hits) is expected to grow rapidly (currently over 35,000 per day). This growth reflects the value placed upon the information being provided. The RDC is responsible for maintaining the infrastructure needed to support this growth without a significant degradation in performance.

System Status - All developmental projects are on schedule.

The RDC and other ISO components are developing a Network Operating Environment (NOE) as a strategy and architecture for the migration away from the Banyan-based LAN Operating System in the Office of Finance and Administration. The NOE is a vendor-independent, standards-based, open-network architecture. Its scope is beyond the traditional file and print services of LAN architectures. In its broadest sense it includes both Intranet and Internet services as well as routine communications and network services. It presents the network as an open and accessible utility from which services can be obtained and applications accessed from any point on the network through direct or indirect means. The network is viewed as a shared common resource that is the main vehicle for transacting daily business both inside and outside the organization. The LAN as a local or self-contained network becomes virtually an obsolete concept. Connectivity and access to any network resource, local, national or international, drives the architecture. Access internally to NOAA's large and diverse computing and database

resources, as well as extensions to the academic, scientific, and governmental communities, defines the scope of the network computing requirements of the NOE.

The major technical underpinnings of the NOE as a network-centric versus a server-centric architecture are: (1) TCP/IP protocols; (2) X.500 based global directory services; (3) mixed use of UNIX, NT, and, where appropriate, Banyan servers and services; (4) modular mix-and-match use of vendor products; (5) IMAP4-based e-mail services; (6) NT servers functioning as application servers; (7) extensive use of browsers as a common user interface; (8) extensive use of collaborative software based on Internet standards; (9) Point-to-Point Protocol support for remote access; and (10) host access via Telnet, TN3270, and the World-Wide-Web.

RDC Performance Measures	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
Network operations support for NOAA Line and Staff Offices:								
% of e-mails processed within 5 minutes	80%+ /80%	80%	80%	80%	80%	80%	80%	80%
Maximum latency for any e-mail	1 hr/ 1 hr	1 hr	1 hr	1 hr	1 hr	1 hr	1 hr	1 hr
# of Internet support accesses (hits)	912.5K / 912.5K	1M	2M	3M	4M	5M	6M	7M

RDC Milestones*	FY Goal
Complete installation of the Alpha 4100 Test and Development enterprise server	FY 97/FY 97
Complete installation of the Alpha 8400 Operations enterprise server	FY 97/FY 98
Implement Network Operating Environment	FY 99
Implement full data warehousing capabilities on the Alpha cluster (undergoing management review)	FY 99
Provide upgraded telecommunications services on the NOAA-net Wide-Area-Network	FY 00
Provide full audio and video Internet services on the Wide-Area-Network	FY 01

* The first entry represent the actual year the milestone was accomplished; the second entry represents the original milestone year in the FY 97 strategic Information Technology Plan.

High Performance Computing and Communication Program (HPCC): In recognition of the importance of high performance computing and communications to its mission, and in support of NOAA's active participation in the Federal interagency HPCC Program (now coordinated through the National Science and Technology Council; Technology Committee; Subcommittee on Computing, Information, and Communications), NOAA has an HPCC Program Office. This Office receives directly appropriated NOAA HPCC funding, and supports high-end computing and advanced networking across NOAA.

The HPCC high-end computing support focuses largely on NOAA's three high-performance computing installations: the National Centers for Environmental Prediction (NCEP), the Geophysical Fluid Dynamics Laboratory (GFDL), and the Forecast Systems Laboratory (FSL). The HPCC Program supports enhancements in the computational capabilities of these installations so they can better meet the needs of the HPCC Grand Challenge applications of climate prediction and weather forecasting. These installations are described elsewhere in this document. The Program also supports Visiting Scientists and other researchers who focus on preparing NOAA to take advantage of massively-parallel computing architectures.

The HPCC advanced networking support focuses on improving NOAA's connectivity to the Internet, so as to improve its ability to disseminate data and information more completely and in a more timely way. Since the HPCC Program is a research program, the networking projects it supports across NOAA usually involve the use of leading-edge technology, including the development and evaluation of test beds. Current emphasis areas include the use of advanced collaboration tools and preparation for NOAA connection to the Next Generation Internet. The HPCC Program supports NOAA's participation on the World-Wide-Web, developing and improving the NOAA Home Page, developing special NOAA-wide sites such as the NOAA Year of the Ocean site, and a registry of NOAA Web sites, and establishing a NOAA Web video/web server.

More information is available on NOAA's HPCC program at its Web site at (http://www.hpcc.noaa.gov).

Budget Estimates ($K): Includes all hardware, software, operational, and support costs associated with the system. Also includes personnel costs for individuals whose primary task is system development, operations, or support.

System	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04
CAMS	8,442	12,874	10,642	8,848	8,848	8,848	8,848
RDC	4,700	5,000	5,200	5,300	5,400	5,500	5,800
HPCC	7,500	12,500	13,500	13,500	13,500	13,500	13,500

Future Investments: As discussed in the Strategic Issues section of this document (see "Information Services Delivery" on page 7), NOAA has recognized the importance of

connectivity and networking to its ability to carry out each of its strategic goals. NOAA has also recognized that investments in this area need to be coordinated so that NOAA as a whole can benefit. An initiative that helps NOAA implement its networking architecture is being developed for possible inclusion in NOAA's FY 2000 budget request. This initiative is "cross-cutting" in that it contributes to the accomplishment of all seven of NOAA's strategic goals.

CONCLUSION

The contents of this plan have shown how NOAA's ability to maintain and improve its service to the Nation depends upon the wise and successful use of IT resources, and that NOAA is using technology both to re-engineer vital business processes and to significantly improve specific services. The plan has also shown that in a diverse agency like NOAA, a wide range of IT actions are needed; NOAA's challenge is to conduct this wide range of activities while maintaining sufficient coordination so that NOAA's IT systems work in an efficient and integrated way. IT is a tool, and it should now be clearer how the tools are to be used and for what purpose. The plan has provided both a comprehensive view of the critical systems and a means for achieving consensus about NOAA's future IT strategy. Management endorsement of this strategy provides direction for NOAA's future IT-related activities.

As stated in the Preface, this document is part of an annual planning and budgeting cycle. As NOAA's planning moves through the next steps in this cycle, and implementation actions start to be taken, there will be adjustments and changes in the plans. Within available resources, and considering changing needs, decisions will have to be made as to which programs and initiatives have the greater priority. These changes will be reflected in the subsequent IT planning activities – the NOAA Operational IT Plan and the supporting documentation for budget initiatives. The Strategic IT and Operational IT Plans, used in conjunction with NOAA's 5-Year Implementation Plans and NOAA Line and Program Office Operating Plans, provide a framework for future tracking of progress and measuring the accomplishments of IT systems. By preparing these plans and documenting the "return on investment" that NOAA is achieving through its IT systems, NOAA is working to implement the management approach mandated by the Government Performance and Results Act.

ACRONYM LIST

AC	Anomaly collation
ACE	Advanced Composition Explorer
ASOS	Automated Surface Observing System
AVHRR	Advanced Very High Resolution Radiometer
AWIPS	Advanced Weather Interactive Processing System
CAC	Computer-Assisted Compilation
CAMS	Commerce Administrative Management System
CEMSCS	Central Environmental Satellite Computer System
CDAS	Command and Data Acquisition Station
CFS	Core Financial System
CIO	Chief Information Officer
COMPS	Customer Order Management Processing System (Data Centers)
CORMS	Continuous Operational Real-time Monitoring System
CORS	Continuously Operating Reference Stations
COTS	Commercial-off-the-shelf
CY	Calendar Year
DMSP	Defense Meteorological Satellite Program
DOA	Department of the Army
DOC	Department of Commerce
DOD	Department of Defense
DPAS	Data Processing and Analysis Subsystem (for NWLON)
ENSO	El Niño-Southern Oscillation
EOSDIS	Earth Observing System Data and Information System
ERL	Environmental Research Laboratories
ESDIM	Environmental Services Data and Information Management
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FAA	Federal Aviation Administration
FBN	Federal Base Network
FEMA	Federal Emergency Management Agency
FIMA	Financial Management System
FIT	Fisheries Information Technology (Architecture)
FSL	Forecast Systems Laboratory
GAO	General Accounting Office
GFDL	Geophysical Fluid Dynamics Laboratory
GIMTACS	GOES I-M Telemetry and Command System
GIS	Geographic Information System
GOES	Geostationary Operational Environmental Satellites
GPRA	Government Performance and Results Act
GPS	Global Positioning System
GSFC	Goddard Space Flight Center
HPCC	High Performance Computing and Communications Program
HPCS	High Performance Computing Section (FSL)
IJPS	Initial Joint Polar System

ISO	Information Systems Office (of Office of Finance and Administration)
IT	Information Technology
JFMIP	Joint Financial Management Improvement Program
LAN	Local Area Network
METOP	Meteorological Operational satellite (EUMETSAT/ESA)
MPP	Massively-Parallel Processor
NAOS	North American Atmospheric Observing System
NARB	Network Advisory Review Board
NASA	National Aeronautics and Space Administration
NCEP	National Centers for Environmental Prediction
NESDIS	National Environmental Satellite, Data, and Information Service
NEXRAD	Next Generation Weather Radar
NFC	National Finance Center
NGS	National Geodetic Survey
NGSIDB	NGS Integrated Data Base System
NIC	Network Information Center
NMFS	National Marine Fisheries Service
NNT	Nearest-Neighbor Tool
NOAA	National Oceanic and Atmospheric Administration
NOC	Network Operations Center
NOE	Network Operating Environment
NORC	NOAA Operations and Research Center
NOS	National Ocean Service
NPOESS	National Polar-orbiting Operational Environmental Satellite System
NSRS	National Spatial Reference System
NSSL	National Severe Storms Laboratory
NSWP	National Space Weather Program
NVDS	NOAA Virtual Data System
NWLON	National Water Level Observation Network
NWS	National Weather Service
NWSTG	NWS Telecommunications Gateway
NWWS	NOAA Weather Wire Service
OAR	Office of Oceanic and Atmospheric Research
OFA	Office of Finance and Administration
OGE	Operations Ground Equipment
OMB	Office of Management and Budget
ORPG	Open Radar Product Generation (for NEXRAD)
PIP	Product Improvement Program (for NEXRAD)
PMEL	Pacific Marine Environmental Laboratory
POES	Polar-orbiting Operational Environmental Satellites
PORTS	Physical Oceanographic Real-Time Systems
PPP	Point-to-Point Protocol
PUP	Principle User Processor (for NEXRAD)
RDA	Radar Data Acquisition
RDC	Resource Development Center

RFI	Request for Information
RFP	Request for Proposals
RPC	Rapid Prototyping Center
RPG	Radar Product Generation (for NEXRAD)
SAA	Satellite Active Archive
SARSAT	Search and Rescue Satellite-Aided Tracking
SCARS	Super Computer-Assisted Revision System
SEC	Space Environment Center
SELDADS	Space Environment Laboratory Data Acquisition and Display System
SMS	Scalable Modeling System
SOCC	Satellite Operations Control Center
SRS	Scalable Runtime System
SST	Sea Surface Temperature
STARS	Standard Terminal Replacement System
TCP/IP	Transmission Control Protocol/Internet Protocol
USAF	United States Air Force
USCG	United States Coast Guard
WAN	Wide Area Network
WFO	Weather Forecast Office
WSR	Weather Surveillance Radar
WWW	World-Wide-Web